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# USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

## ELECTRONICS AND ELECTRICAL ENGINEERING

No. 29

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USSR

UDC 621.375.1:62-52

A SUMMING AMPLIFIER WITH SWITCHABLE STRUCTURE

Moscow AVTOMATIKA I TELEMEXHANIKA No 1, 1977 pp 164-167 manuscript received 27 Jan 76

SHAROV, A. N., and SHAROV, S. N., Leningrad

[Abstract] Considered here is an amplifier for the error of follow-up systems based on integral operational amplifiers, which make possible the simultaneous summation of DC and AC signals. The dependence of the output signal on the input and control signals, as well as the parameters of the operational amplifier, is studied. Results of the experimental portion are shown graphically. Figures 2; references 1 (Russian).

USSR

UDC 621.375.026:621.375.126

OPTIMIZATION OF POWER RESONANCE MULTISTAGE ELECTRONIC AMPLIFIERS

Moscow RADIOTEKHNIKA in Russian Vol 31 No 12, 1976 pp 88-93 manuscript received after completion 17 Nov 75

GELLER, V. M., and LASTOCHKINA, L. P.

[Abstract] An algorithm is proposed for calculating the optimum power parameters of a power double-stage resonance amplifier with the use of the system of independent parameters of the device as a whole. The proposed algorithm can be corrected and used in an N-stage amplifier. The conditions of the systems of energy optimization of the multistage resonance power amplifier based on minimizing the total electric power consumption are formulated. The introduction of the approximating function ( $I_{a1}/I_{c1}$ ), which determines with acceptable precision the current distribution in an electron tube in basic regimes, made it possible to express the parameters of the optimal regime for the output stage of a double-stage resonance power amplifier constructed according to circuits with feedback in terms of three basic constants: the static steepness  $S$ , the resistance of the anode resonator and the gain of the exciter. It is possible to correct the proposed optimum calculation algorithm as applied to a N-stage resonance amplifier. Figures 11; references 8 (Russian).

## SPURIOUS AUTOMATIC MODULATION IN LINEAR TRANSISTORIZED POWER AMPLIFIERS

Moscow ELEKTROSVYAZ' in Russian No 12, 1976 pp 67-70 manuscript received  
30 May 74

CHUGAYEV, V. N.

[Abstract] On the basis of analyzing the spectral composition of the output current, a study is made of the effect of the spurious amplitude modulation on the level of nonlinear distortions and the gain of the amplifier, and practical recommendations are made with respect to the optimum construction of the input network of the transmitter stages with single sideband. The procedure used is based on an approximate harmonic analysis applying the Bessel formulas and a representation of the transistorized stage by a special G-function which approximates comparatively exactly the characteristic of a nonlinear element. An analysis of a wide-band amplifier is performed with inclusion of a transistor in a circuit with a common emitter. The results of an experimental test of a single-stage amplifier based on the KT-912 transistor, with output power at the peak of the envelope of the two-tone signal of 35 watts at a frequency of 5 MHz with a frequency dispersion of 1 KHz and various magnitudes of the resistance, demonstrated that the efficiency and level of nonlinear distortions of the amplifier increase with an increase in the resistance, which agrees with the theoretical conclusions. Some practical recommendations are made on the basis of the theoretical conclusions and the experimental results. Figures 4; references 6: 5 Russian, 1 Western.

USSR

UDC 621.396.67

SYNTHESIS OF AN ASYMMETRICALLY EXCITED IMPEDANCE ANTENNA

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 12, 1976 pp 1871-1874

CHAPLIN, A. F., and LOBACHEV, V. A., Moscow Power Engineering Institute

[Abstract] The problem of synthesis of an impedance antenna in the shape of a strip on the envelope of a perfectly conducting cylinder is examined. Excitation is generated by a ring slot with a traveling current wave. Realization of surface impedance is suggested in the form of a ribbed small-period structure which is needed for reactance conditions. This condition is written as the integral convolution equation, which is solved numerically by reducing it to a re-defined system of quadratic equations and using numerical optimization methods. To satisfy the reactance condition, free highest harmonics of the secondary field are used. The problem is solved to yield numerical results, which show the surface impedance distribution to obtain a radiation pattern. Figures 2; references 5: 4 Russian, 1 Western.

POLAND

UDC 621.396.67

PROSPECTS FOR THE USE OF MULTIBEAM ANTENNA ARRAYS ON COMMUNICATIONS  
SATELLITES

Warsaw PRZEGLAD TELEKOMUNIKACYJNY in Polish No 8-9, 76 pp 263-267

ROEDERER, ANTOINE, European Space Research and Technology Center, Noordwijk,  
Holland

[Abstract] The author discusses the use of multibeam antenna arrays in communications satellites and its impact on the system performance. After a brief description of the elements of antenna arrays, problems are examined connected with their use such as the selection of arrays, the performance prediction and measurements. Typical examples are given to illustrate the improvement expected from the use of antenna arrays on communications satellites. Figures 10; tables 1.



USSR

UDC 621.396.676.71

PROCEDURE FOR CALCULATING A SLIT ANTENNA MADE FROM AN ASYMMETRIC STRIP LINE

Moscow RADIOTEKHNIKA in Russian Vol 31 No 12, 1976 pp 45-48 manuscript received 12 Feb 75

TERESHIN, O. N., YUVKO, A. N., and BOROVIK, N. V.

[Abstract] A discussion is presented of a procedure for calculating a slit antenna with reactive loads included in the slit, with the mutual coupling among the elements taken into account. The procedure presented makes it possible to use the given field characteristic of the radiation to calculate the electric and geometric parameters of an antenna in the form of a system of equidistant slits cut in one of the metal plates of an asymmetric strip line and loaded under reactances. The experimental results confirm the validity of the assumptions. Figures 5; references 8 (Russian).

USSR

UDC 621.396.677

INVESTIGATION OF THE EFFECTIVENESS OF COMMUTATING ANTENNA ARRAYS IN THE DIRECTIONAL SEPARATION OF INCOMING SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 56-63 manuscript received 8 Oct 75

ABRAMOVICH, YU. N., and DANILOV, B. G.

[Abstract] The problem of suppressing the side lobes of a broadside antenna array without reducing the principal peak by more than an allowable amount is treated as an optimization problem and solved here by searching for a discrete phase distribution of an N-element array which will accomplish this. The method of dynamic programming, used for biphasal arrays, is extended to multiphasal ones with an arbitrary phase discretization. The principle can also be applied to the synthesis of "thinned out" nonequidistant arrays. Figures 3; tables 2; references 10: 8 Russian, 2 Western.

USSR

UDC 621.396.677.012.12

CORRELATION BETWEEN CURRENT FLUCTUATIONS IN ANTENNA ARRAYS CAUSED BY INTER-ACTION BETWEEN RADIATORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 53-55  
manuscript received 6 Oct 75

DORFMAN, YA. M.

[Abstract] An expression is derived for the correlation coefficient (radius) which characterizes the effect which the coupling between the fields of radiators in an antenna array has on the fluctuations of currents. The array of N separately fed radiators is assumed, for simplicity, to be linear and equidistant with the current fluctuations caused by fluctuating input impedances. Numerical results are shown for half-wavelength radiators with a characteristic impedance  $Z_0 = 75\Omega$ . Tables 1; references 7 (Russian).

USSR

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DIFFRACTION OF A SCALAR WAVE AT A PARABOLIC MIRROR

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22 No 1, Jan 77 pp 1-9  
manuscript received 18 May 76

FEL'D, YA. N., and ANSRYAN, A. K.

[Abstract] A thin paraboloidal mirror antenna is considered with a point source of radiation at the focus. The surface "current" as well as the excited secondary (diffracted) field and its directivity diagram are analyzed by Schmidt's orthogonalization method with a subsequent sphere-segment approximation in spherical coordinates, for the case of Dirichlet's boundary conditions (jump of the normal field gradient) and for Neumann's boundary conditions (jump of the field intensity). Numerical solutions have been obtained with the aid of a digital computer, and the results are presented here in appropriate graphical form. Figures 4; tables 1; references 2 (Russian).

USSR

TOWER-TYPE ANTENNA FOR TRAIN RADIO COMMUNICATIONS

Moscow AVTOMATIKA-TELEMEKHANIKA-SVYAZ in Russian No 12, 1976 p 32

KUZIN, V. F., senior engineer, Syzranskiy'interval of Kuybyshev Road

[Abstract] At many of the railroad stations there are metal floodlight towers for outside illumination located near the stationary train radio communications stations. These towers can be used successfully as a vertical rounded shunted feed antenna. The great height of the towers (24-32 meters) and the presence of good loop grounding make these antennas appreciably more efficient than the standard 15 meter L-type antennas. A schematic is presented of the excitation of the floodlight tower by the high-frequency signal. When using the floodlight tower as an antenna it is necessary that the supporting lines of the various overhead cables and the elements of the contact network attached to the tower be insulated from it. A floodlight tower is in use at the Oktyabr'sk Station in place of the 20 meter inclined-beam type antenna. The level of useful signal at electric locomotives on the run has been increased on the average by 15 decibels, and at the entrance to the radio station, on the average by 10 decibels. This has made it possible to eliminate dead zones. Figures 2.

USSR

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OPTIMUM FILTRATION OF SIGNALS IN ASYNCHRONOUS ADDRESS COMMUNICATION SYSTEMS  
BETWEEN MOVING OBJECTS

Moscow RADIOTEKHNIKA in Russian Vol 32 No 1, 1977 pp 21-28

CHERNYAKOV, M. V.

[Abstract] The Markov theory of optimum nonlinear filtration in gaussian approximation is used to solve the problem of optimum reception of signals with time-and-pulse modulation in an asynchronous address system between moving objects. Equations and filtration error graphs are given to evaluate the filtration error under transient conditions of the asynchronous address system receiver with frequency-time coding and time-pulse modulation of signals. Figures 3; references 4 (Russian).

USSR

UDC 621.371.3:621.391.82

STUDY OF THE TRANSMISSION OF DIGITAL DATA THROUGH INTERMEDIATE WAVE CHANNELS  
IN MARINE RADIOCOMMUNICATIONS

Moscow RADIOTEKHNIKA in Russian Vol 31 No 12, 1976 pp 41-44 manuscript  
received 9 Sep 74, after completion 9 Apr 75

ARZUMANYAN, YU. V., VENSKAUSKAS, K. K., NAUMOV, A. S., and SOKOLOV, B. P.

[Abstract] Tests were run in the Black Sea Basin to determine the actual noise immunity of the known methods of reception for various methods of manipulating the useful signal when transmitting digital data over intermediate wave channels in marine radio communications. A study was also made of the possibility of increasing this noise resistance by introducing redundancy into the useful signal and constructing special domodulators. In order to investigate the possibility of increasing the noise immunity under the conditions of narrow band noise and fading, FM signals were transmitted and received over two parallel channels. When using two parallel channels and in the presence of narrow band noise the greatest noise immunity occurs in the multiplication regime. Its advantages in comparison with the quadratic addition and single reception regimes for FM signals depend on the depth of fading and the noise level. On the average the probability of error is ten times smaller. In the absence of narrow-band noise the best results are achieved in the quadratic addition regime. Thus, it is expedient to use the proposed algorithm for the reception of FM signals in the channels where narrow-band noise predominates and the realization of the optimal algorithms causes great difficulties or is impossible as a result of their complexity. By comparing the results of receiving single relative phase-manipulation and frequency-modulation signals at a rate of 100 baud it is obvious that in the intermediate wave channels FM gives the best results. The advantages of FM in comparison with relative phase manipulation which amounts to 1.5 to 2 times can obviously be explained by the quite strong fluctuations of the signal phase,

the  $90^\circ$  probability of variation of which during the elementary sending was about  $10^{-2}$ , and by  $180^\circ$  about  $10^{-3}$ . Figures 4; tables 1; references 6: 5 Russian, 1 Western.

USSR

UDC 621.372.55:621.397.8

#### STANDARDIZED PASSIVE VIDEOCORRECTOR FOR COAXIAL CONNECTING LINES

Moscow VESTNIK SVYAZI No 12, 1976 pp 18-21

STRIZHEVSKIY, N. Z., senior scientific associate of NIIR [expansion unknown] candidate of technical sciences

[Abstract] The technical specifications, operating principle and operating advantages are presented for the standardized passive video corrector for coaxial connecting lines, executed in accordance with USSR Author's Certificate No. 536604 for a "Passive Connecting Line Corrector" published in 1976. The corrector regulators permit it to be adjusted individually on location for each connecting line. It can be used to design individual correctors for connecting lines. The corrector comprises a circuit of T-type overlapped elements. In order to make a correction for any of the connecting lines of one coset (distortions below a given limit, wave impedances equal, one time-frequency transmission region), each element, in its time interval, introduces the compensating alinement to the top of the transient characteristic controlled by the level and time constant and, in its frequency range, the compensating alinements of the section of the frequency damping and delay characteristics controlled by the level and the mean frequency. The structural diagram and circuit diagram of the standardized video corrector are presented. Figures 5.

USSR

UDC 621.373.826:621.395.6

#### PRINCIPLES OF CONSTRUCTING COMMUNICATIONS NETWORKS USING OPTICAL CABLES

Moscow ELEKTROSVYAZ' in Russian No 12, 1976 pp 58-59 manuscript received 17 Feb 75

ZAKHAROV, A. S.

[Abstract] As a result of the simplicity of designing amplifiers executed from integrated microcircuits and the comparatively short length of the amplifying sections, access to the optical cable channels is realized by the simple connection of the subscriber unit to the amplifiers. This makes it possible to create a communication system with multiple access similar to a satellite system. The newly designed system is a branched network without central units which interrupt the operation of the entire network if they fail. A schematic of the network is presented. It operates on the following

principles: 1) Each subscriber has access to the total information flow transmitted in the system by connecting to the amplifier and can select messages addressed to it or transmit messages to other subscribers by corresponding addressing; 2) Two optical cables--for transmission and reception--are brought to each subscriber unit; and 3) The bunches of optical cables are connected to each other at the junction points so that condition one is satisfied. The frequency, time or code method of multiplexing is used in the system. If a cable is damaged only part of the network fails. Other advantages of the communications network with decentralized commutation described includes simplicity of expansion and high reliability, and the absence of commutation devices and facilities for them. Figures 2; references 5: 1 Russian, 4 Western (translated into Russian).

USSR

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SYNTHESIS OF A STABLE LINEAR DETECTOR ON THE BASIS OF AN INCOMPLETELY KNOWN SIGNAL

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 195-199  
manuscript received 24 Oct 75

ALEYNER, R. SH.

[Abstract] An optimally stable linear detector is synthesized by the mini-max method, on the basis of an incompletely known useful signal. The signal amplitude is unknown and the signal form deviates from a known reference within a certain mean-squared error (ignorance index). The noise appearing with such a signal is normal and its correlation function is known exactly. This detector is compared with an ordinary one built for a completely known signal and, with the proper signal metrics and normalization, both are found structurally identical. Unambiguous normalization of the signal form causes changes in the optimally stable linear detector and improves its stability. References 3 (Russian - one translation).

USSR

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NOISE IMMUNITY OF COHERENT AND INCOHERENT SPACED RECEPTION WITH COHERENT  
SUPERPOSITION OF SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 183-186  
manuscript received 4 Nov 75

FAL'KO, A. I.

[Abstract] Algorithms of signal reception adaptive with respect to concentrated noise serve as the basis for analyzing the error probability in coherent spaced reception and in incoherent spaced reception with coherent superposition of signals. Binary signals with equal energy contents are considered in each case, decaying signals representing a particular situation, and the noise parameters are assumed to vary in the channels at a finite rate. The resulting algorithms for determining the error probability indicate that the latter generally depends on the spectral energy density of the noise and on the rate of change of the noise parameters. In the extreme case of a zero rate of change we have a channel whose characteristics are those of one with Rayleigh signals submerged in white noise. References 3 (Russian).

USSR

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NOISE IMMUNITY OF OPTIMUM AND QUASI-OPTIMUM RANKWISE SIGNAL DETECTION BY THE  
"CONTRAST" METHOD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 191-195  
manuscript received 10 Nov 75

KALYUZHNYI, A. YA., and KRASNYY, L. G.

[Abstract] Algorithms for rankwise detection of signals are considered, with the input data describing the envelope of a process at the output of any conventional receiver channel. The detection proceeds in two stages: conversion of the data to ranks and calculation of the rank statistics. A subsequent comparison of the latter with the false-alarm threshold renders the decision as to the presence or the absence of a signal. An optimization of this procedure reduces to a calculation of the likelihood ratio of rank-vector distributions corresponding, respectively, to the "signal present" hypothesis and the "signal absent" hypothesis. This general procedure is applied to signals with a random initial phase and a fluctuating amplitude, submerged in Gaussian noise. Four known detection algorithms are: optimum rankwise processing, detector locally optimum near the zero ratio of signal power to noise dispersion, Wilcoxon detector, and two-stage detector with randomization. In addition, a new type of detector is proposed: a detector of rank codes where the components of the rank vector are first rearranged in the order of decreasing magnitudes and the calculation of the rank follows. The noise immunity of this detector has been found higher than that of any

other of the quasi-optimum detectors described here. The noise level in the worst of all these cases is not more than 0.5 dB higher than in optimum detection, over the entire false-alarm range. Figures 3; references 3 (Russian).

USSR

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#### SPACE-TIME PROCESSING OF SIGNALS WITHIN THE FRESNEL ZONE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 72-79  
manuscript received 28 Oct 75

KREMER, I. YA., and PON'KIN, V. A.

[Abstract] The problem of optimally receiving signals within the Fresnel zone, in the presence of inherent apparatus noise as well as of extraneous point sources of quasi-white noise, is solved analytically by a space-time processing of signals. With the signal and the noise appropriately described, the optimum processing system is found and, as an evaluation test, the signal-to-noise ratio at its output is calculated. With either the signal source or the noise sources (or both) located within the Fresnel zone of the receiver antenna, information about the wave-front curvature provides extra means with which a signal can be extracted. In this case a simpler matched space-time processing is less effective than optimum processing but more advantageous than without the use of those curvature data. Figures 3; references 4 (Russian).

USSR

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#### CODES GENERATED BY FAST-SCAN SEQUENCES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 190-191  
manuscript received 24 Oct 75

LOSEV, V. V.

[Abstract] Fast-scan sequences of  $N = 2^n$  length, which have been described earlier, are shown here to be related to cyclic codes for data transmission. This relation is derived from basic concepts pertaining to polynomial rings, idempotents, and binary fields. Polynomials are built which generate codes with generating polynomials. Any fast-scan sequence generates two cyclic codes and its two first symbols, appropriately converted, are words of these codes. The search for synchronism with respect to code words can thus be simplified by discarding all special synchronizing sequences which do not belong to a given code. Encoding of weighted cycles is not unique. The number of possible codings is  $2^L$ , where  $L$  denotes the number of weighted



cycles and is equal to a double sum of a Moebius series. Each encoding generates its idempotents and thus its cyclic codes, some of them well known for their outstanding properties. References 4: 2 Russian, 2 Western.

USSR

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EXTRACTING A SIGNAL OF UNKNOWN LENGTH FROM WHITE NOISE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 90-98  
manuscript received 22 Oct 75

TRIFONOV, A. P.

[Abstract] A signal is considered in the form of a rectangular pulse of unknown width, appearing together with a white noise of a known unilateral spectral density. The probability of errors, of the first kind and of the second kind, in detecting such a signal by a maximum-likelihood or some other quasi-optimum receiver is evaluated and, in the maximum-likelihood case, the signal length (pulse width) is estimated on the assumption that the given signal (pulse) will always appear at the receiver input. An asymptotic expressions for the dispersion of the normalized estimate, as a function of the signal-to-noise ratio, is derived and compared with exact ones at sufficiently high ratios. Figures 3; references 8 (Russian).

USSR

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TWO METHODS OF DISCERNING QUANTUM SIGNALS IN A GAUSSIAN NOISE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 186-190  
manuscript received 3 Nov 75

VANTSYAN, A. G.

[Abstract] The problem of discerning  $M$  a priori equiprobable quantum signals is considered here without disregarding the presence of thermal background noise. Quasi-optimum algorithms for determining the error probability are derived by two methods. The method of amplitudes is applicable to orthogonal signals, but useless in the case of linearly dependent (e.g., simplex) signals. The method of coherent quasi-measurement is more universal, but most advantageous in the case of simplex signals. The mean energy of several signals is related to the separation between them, differently in each case, and so the error probability can in each case be expressed as a particular monotonically (exponentially) decreasing function of either the mean energy

or the separation. The results shown here for three symmetric (equally separated) signals indicate the relative merits of both methods. The author thanks R. L. Stratonovich for attention to the work, and for a number of helpful remarks. Figures 2; references 6: 5 Russian, 1 Western.

USSR

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OPTIMUM DISCRETE PROCESSING OF CONTINUOUS RADIO SIGNALS OF UNKNOWN FREQUENCY IN THE PRESENCE OF NOISE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 99-108  
manuscript received 3 Nov 75

YARLYKOV, M. S., and KHRISTOV, A. A.

[Abstract] A continuous radio signal of unknown frequency is additively mixed with a Gaussian white noise of known statistical characteristics. Both random fluctuations and Doppler shifts of the signal frequency are taken into account when such a signal is optimally processed by nonlinear continuous-discrete filtration, with the aid of a digital computer. The structure of an optimum discrete-type radio receiver is designed for this accordingly and its noise immunity then evaluated. Figures 5; references 11: 6 Russian, 5 Western.

USSR

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COMPATIBLE DISTRIBUTION OF PULSE WIDTHS AND PAUSE WIDTHS IN A COINCIDENCE FLUX

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 204-207  
manuscript received 6 Oct 75

SHLYAPOSHNIKOV, V. M.

[Abstract] Pulses and pauses in the flux resulting from a multiplication of mutually independent regeneration fluxes, each with a given pulse distribution density and a given pause distribution density, are dependent (except in the case of exponential pulse distributions). Consequently, a determination of the unconditional pulse and pause densities in the resultant flux is not sufficient for a probabilistic description of their sequence. An analysis based on recurrence relations leading to a Volterra integral equation yields the conditional distribution density of the derivative of that sequence. References 1 (Russian).

USSR

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SIGNAL-TO-NOISE RATIO IN THE DETECTION OF OPTICAL VARIABLE-WIDTH PULSE  
SIGNALS SUBMERGED IN CORRELATIONAL NOISE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 199-  
203 manuscript received 20 Oct 75

SHEMSHEDINOV, R. B., and KAZAKOVA, G. S.

[Abstract] The detection of optical variable-width signals submerged in correlational Gaussian noise by adaptive (depending on the signal width) and nonadaptive (optimized with respect to a certain signal width) photoreceivers is analyzed, with the photodetector inertia and the noise correlationality taken into account simultaneously. The threshold relations in both kinds of photodetectors are compared. The signal-to-noise ratio is of particular interest and, in terms of this criterion, adaptation is found to become more effective with increasing signal width. The photodetector inertia as well as the amplifier noise level limit the attainable signal-to-noise ratio. An inertialess adaptive device combined with a very steep energy spectrum of the low-frequency noise will yield the maximum signal-to-noise ratio. Figures 2; references 9 (Russian).

USSR

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PECULIARITIES OF INFORMATION TRANSFER FROM TELEGRAPH EQUIPMENT IN COMPUTER-  
IZED DATA PROCESSING SYSTEMS

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4(88),  
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SAVELYEV, B. A., YEREMENKO, A. V., candidates of technical sciences, and  
CHERNETSOV, G. N., engineer

[Abstract] Features are analyzed for the noise-resistance of information transfer from telegraph equipment using MTK Codes 2 and 5, and their effect on the selection of a redundancy code. A code is proposed for information transfer in start-stop/sync systems, providing transient transmissions with current and future telegraphic equipment. Requirements are as follows: start-stop cycle must be  $145 \frac{5}{6}$  ms or 7.29 single elements at a rate of telegraphy of 50 Bod. Probable error must be no greater than  $(1-3) \times 10^{-5}$ . The code bundle length should be 260, 500 or 960 single elements. Code 74.58 proves to be best for data transmission across telegraphic equipment, subdividing the bundle lengths of 260, 500 or 960 elements into sub-bundles. Figure 1; table 1.

USSR

UDC 621.395.001.2

NUMBER OF DIRECT CHANNELS BETWEEN TELEPHONE NETWORK OFFICES

Moscow ELEKTROSVYAZ' in Russian No 12, 1976 pp 40-47 manuscript received 11 Feb 75

ZABLUDOVSKAYA, E. S., and LEZERSON, V. K.

[Abstract] A procedure is developed for determining the number of direct channels between offices when designing a telephone network. Formulas are derived for calculating the number of high-use direct channels and for determining the magnitude of the excess load from the growth of the total load on the network. Among all the possible distributions of the channels in the forward and return directions it is necessary to select the one for which the total magnitude of the excess load (or the total number of bypass channels) will be minimal. This minimum always exists as is proved in the given theorem and corollary using the Erlang formula. Another more complicated proof of the theorem was previously given by R. S. Krupp, A. Descloux, M. M. Buchner and S. R. Neal in unpublished papers. Figures 2; tables 2; references 3: 2 Russian, 1 Western.

USSR

UDC 621.395.4:621.375.132

AUXILIARY LOW-FREQUENCY EQUIPMENT FOR THE K-60P TRANSMISSION SYSTEM

Moscow VESTNIK SVYAZI No 12, 1976 pp 12-15

GOLYSHKO, Z. I., SHAMSHIN, V. M., SMALYUK, V. K., and SMIRNOVA, L. A., Colleagues, TsNIIS [Central Scientific-Research Institute of Communications]

[Abstract] A description is presented of the auxiliary low-frequency equipment for the K-60P transmission system developed by the TsNIIS. This new equipment provides for the transmission and reception of service communication signals in the frequency band of 0.3 to 3.4 kilohertz and remote control signals for other information in the frequency spectrum of 4.1-7.7 kilohertz. Use of this equipment, which at the present time is being series manufactured in the Soviet Union for remote control stations, in accordance with technical specifications DTO.215002 TU, is expected to improve significantly the operating reliability of the K-60P transmission systems. Block diagrams of the transmission and reception channels of the remote control equipment for the K-60P transmission system, and the filter circuit are presented. The frequency damping characteristic of the transmission filters and the amplitude correctors are given. Circuit diagrams are included for the temperature corrector and the VUS-1 auxiliary amplifier used in the K-60P system. The temperature corrector compensates for the operating errors of the automatic gain control, the thermal variations of the damping of the adjacent cable

section and a 300 km long section. The amplitude correctors are designed to compensate for the total frequency-amplitude distortions accumulated in the service communications channel and in the auxiliary channel in the cable section up to 300 km long. Figures 7.

POLAND

UDC 621.395.7

RESULTS OF OPERATION OF AUTOMATIC ELECTRONIC TELEPHONE EXCHANGES

Warsaw PRZEGLAD TELEKOMUNIKACYJNY in Polish No 8-9, Aug/Sep 76 pp 244-251

BUCZKOWSKI, JANUSZ, University of Nairobi, Kenya

[Abstract] A survey is made of the results of operation of automatic telephone exchanges of various types, viz.: ESS (USA), SP-1 (Bell Canada), Metaconta ITT, D-10 (Japan), Telefonbau and Normalzeit (TNZ-FRG) and PCM (England). The author discusses operational experiences and failures of the equipment, programming problems, service conditions, maintenance facilities, and the introducing of electronic exchanges into already existing networks. Figures 12; tables 8; references 15 (Western).

USSR

UDC 621.395.73:621.317.3

REDUCING THE TIME NEEDED TO PINPOINT DAMAGE TO CABLE STRAND INSULATION

Moscow VESTNIK SVYAZI No 12, 1976 pp 24-25

KAMRAZ, E. V., engineer-measurer, SMU-15 "Mezhgursvyaz'stray" [Construction and Installation Administration, All-Union State Trust for the Construction of Long-Distance Wire Communications Structures]

[Abstract] A scheme is presented for reducing the time required to pinpoint the damage to cable core insulation. The usual procedure for pinpointing damage uses two auxiliary conductors, a galvanometer and a battery. The auxiliary conductors are connected to the damaged core, and the operator walks out the measured cable, periodically connecting one of the terminals of the battery to one of the auxiliary conductors. Another operator notes the readings of a galvanometer connected to the other auxiliary conductor. In the proposed scheme the microtelephone of the person taking the readings is connected in series in the feed circuit which forms a bridge circuit so that it does not introduce errors into the measurements. Using the described procedure for taking the galvanometer readings, the possible damaged section of the cable is reduced to 15 or 20 meters which have to be checked out more precisely, instead of the usual several hundred meters between junction boxes.

USSR

UDC 621.395.74.001.2:681.3

ALGORITHM FOR FINDING THE OPTIMAL ROUTE FOR A RURAL TELEPHONE NETWORK CABLE

Moscow ELEKTROSVYAZ' in Russian No 12, 1976 pp 55-58 manuscript received 16 Oct 74

MURDASOV, A. B.

[Abstract] An algorithm for finding the optimal route of the cable line for a rural telephone network is discussed. In calculating the economically optimum route of the cable between two given points on the rural telephone network it is necessary to select the minimum reduced or capital expenditures on installing the cable as the most favorable criterion. The algorithm which is designed to be used on a computer comprises the following modules: 1) Processing the initial data and recording them in memory; 2) The distance between two adjacent points for each side of a polygon is analyzed. If it exceeds a sufficient small interval  $l_0$ , then new additional points are introduced. Their coordinates and numbers are recorded in memory; 3) The generalized distances from the given point on the polyhedron to the remaining points of the polyhedron along a straight line without intersection with its other sides and also with two adjacent points are found (the generalized distances equal to the product of the cost of laying

1 km of cable times the distance in Euclidian metric space); and 4) A module is designed for determining the shortest distance between two points A and B on the graph of the network. It is expedient to use the Minti algorithm which has computer programs for this purpose. Some example polyhedrons and the formulas for finding the generalized distances are given. After obtaining the optimal route for the cable with respect to the economic parameters, the designer calculates dangerous and interfering effects. Sections along which the cable cannot be laid are determined, and after corresponding corrections to the initial data the calculations are repeated. Figures 4; references 3 (Russian).

USSR

UDC 621.395.374

SOME RESULTS AND PROBLEMS OF AUTOMATING THE LONG-DISTANCE TELEPHONE COMMUNICATIONS: FROM THE WORK EXPERIENCE OF THE LENINGRAD LONG-DISTANCE TELEPHONE NETWORK

Moscow ELEKTROSVYAZ' in Russian No 12, 1976 pp 27-34 manuscript received 22 Jul 76

PEVTSOV, N. V., SVEREV, B. V., and SHMIDT, YE. L.

[Abstract] Some results and problems of the automation of the long-distance telephone network out of Leningrad are discussed. During the Ninth Five-Year Plan the number of automated outward lines increased by 2.7 times, the number of automated inward lines by two times, and the number of coin telephones in Leningrad increased by 2.5 times. This made it possible to raise the level of automation of the outward lines to 66 percent and the inward lines to 92.7 percent with the tandem connections 83.2 percent automated. The introduction in Leningrad in 1974 of the modern coordinated automated long distance telephone system, type ARM-201/4 built in Yugoslavia was accompanied by significant reequipment of the entire municipal telephone network. The number of attempts to establish one connection during the first months of operation of the ARM-201/4 varied within the limits of 1.85 to 2.1. This index is now stabilized at 1.5 to 1.6. An analysis is presented of the monthly statistics for the automated telephone office and the number of cases of permanent busy on the channels after disconnect, the systems of tariffs and charges on the telephone network and the use of multizone MTA-15-2 automatic long distance toll telephone equipment. Figures 4.



## SELECTION OF THE FAMILY OF TRANSMISSION SYSTEMS FOR A MAIN COMMUNICATIONS NETWORK

Moscow ELEKTROSVYAZ' in Russian No 12, 1976 pp 35-40 manuscript received 10 Dec 75

OYSGEL'T, M. G., and FARBER, YU. D.

[Abstract] Beginning with the data on the requirements for various bunched channels, the number of types of transmission systems and the number of channels in each of them were determined for which sufficiently efficient use of the channels is insured and the total expenditures on building the network are minimal. A general solution is proposed for the problem formulated; numerical solutions are presented which are found for various initial data selected as examples; the expected expenditures on the construction of a network using the existing or calculated transmission systems are compared; and the practical urgency of the problem of the optimization of the family of transmission systems (both with frequency and time division of the signals) is confirmed. The analysis and the results of numerical calculations indicate that one of the means of reducing the expenditures for creating the main communications network might be to use a family of transmission systems, the carrying capacities (number of channels) of which are selected considering the distribution law of the demands for communication channels. The procedure described in the article can be used as the basis for selecting the number of systems in the family and the number of channels in each of them. The preparation of the initial data does not cause significant difficulties, and the calculations on a computer in order to determine the optimum number of channels are simple and brief. The use of transmission systems with the calculated number of channels will create the prerequisites for more economical placement of junctions on the network. The carrying capacities of the main line coming into these junctions must be selected so that the demand for the terminal and tandem communications will be satisfied with the least possible redundancy. A comparison of the various versions of the location of the junctions can be made by the maximum efficiency of use of the systems organized in adjacent regions. The efficiency of the use of the transmission systems is expediently included in the number of indexes normalized for the specific design. Figures 2; references 2 (Russian).

USSR

UDC 621.396

INTERFERENCE IN THE ASYNCHRONOUS ADDRESS COMMUNICATION SYSTEMS DURING OPERATION IN THE ULTRASHORT WAVE RANGE

Moscow RADIOTEKHNIKA in Russian Vol 31 No 12, 1976 pp 81-83 manuscript received 1 Apr 76

KITAYEVA, V. K.

[Abstract] A study was made to determine the level of the mutual interference in asynchronous address communication systems in the ultrashort wave range. Formulas are derived and a discussion is presented for the signal power at the reception point, the average power of the interference and the signal-to-noise ratio. The propagation of radiowaves over a flat semiconducting surface of the earth is considered for both antennas (transmitting and receiving) or directly at the interface. The minimum signal-to-noise ratio is found for the case where the transmitter of the operating subscriber radio transmitting the useful information is located at the maximum permissible distance. References 6 (Russian).

POLAND

UDC 621.396.11

BROADBAND LASER LINK

Warsaw PRZEGLAD TELEKOMUNIKACYJNY in Polish No 8-9, Aug/Sept 76 pp 252-255

HEL SZTYNSKI, JERZY; RZEWUSKI, MICHAL; JASIEWICZ, WIESLAW; CAR, ROMUALD;  
SLIWA, LECH; and LEWANDOWSKI, LESZEK, Institute of Fundamentals of Electronics, Warsaw Polytechnic

[Abstract] The atmospheric laser link of 100 MHz bandwidth at wavelength 0.6328  $\mu\text{m}$ , developed at the Institute of Fundamentals of Electronics of the Warsaw Polytechnic, is described. Using a He-Ne LG-600 type multimode laser link produced by the Polish Optical Plants, the avalanche photodiode, and the IM/FM modulation, the composite color TV signals were successfully transmitted. The equipment used, the mode of operation and its results are presented and discussed. Figures 6; references 4: 3 Polish, 1 Western.

USSR

UDC 621.396.43

ON ONE METHOD OF RETRANSMISSION OF SIGNALS WITH CONVERSION OF COMPRESSION  
TYPE ON BOARD A SATELLITE

Moscow RADIOTEKHNIKA in Russian Vol 32 No 1, 1977 pp 11-15

GUTIN, V. S.

[Abstract] Until recently one of the main requirements for planning satellite communications systems was maximum simplification of equipment to be placed on board the satellites, even if this entailed complication of earth-based equipment. On-board equipment may be made more complex in one of two ways: power engineering and functional. The first consists of increasing the sensitivity of receivers and the output of on-board transmitters. The second involves replacing traditional "through" retransmission by retransmission with signal processing and channel commutation on board the satellite. Not much information has been published about signal processing on board satellites. This method can be used even for analog transmission, corresponding to a given method of digitization (delta modulation, code-pulse modulation, etc.). Figures 5; references 10: 6 Russian, 4 Western.

USSR

UDC 621.396.67

PROCEDURE FOR ACCELERATED CHECKING OF THE VERTICALNESS OF TOWERS

Moscow VESTNIK SVYAZI No 12, 1976 pp 21-24

GERTSVOL'F, V. A., engineer

[Abstract] A discussion is presented of a united procedure for taking measurements and processing the data obtained when determining the verticalness of masts and towers of different structural designs for radio-television transmission centers and radio relay communication lines. The procedure can be used not only to test the vertical position of the high-rise communication structures performing the functions of antenna support but also for other structures having a ratio of the base width to the overall height within the limits of 1/4 to 1/17. The example presented of the practical application of the given procedure and the measurement results is concerned with a lattice-type tower with a base with a square cross section in the planned view. The basis for the procedure is the "method of angles," well known in engineering geodetics. The variables are measured by a carefully adjusted theodolite from two permanently installed stands, I and II. The horizontal projections of the directions from these stands on the vertical axis of the structure must be mutually perpendicular. The points for the stands I and II must lie on continuations of either the diagonals of the base or the perpendiculars to the middle of the sides of the base of the structure. The distances from the geometric center of the base of the structure to the theodolite stands I and II are selected as a function of the local conditions,

within the limits of 1.0-1.5 H (height of the structure in meters). The relative measurement error in measuring distances must not exceed 1/500. Tabulated data and schematics are presented from some field measurements of verticalness made by the presented procedure. A nomogram is given for conversion of the measured deviations to linear values. Figures 4; tables 3.

USSR

UDC 621.397

A METHOD OF IMAGE COMPRESSION EMPLOYING PREDICTION AND ADAPTIVE DISCRETIZATION

Moscow IZVESTIYA VLIZ: PRIBOROSTROYENIYE Vol 19 No 12, 76 pp 15-18 manuscript received 29 Mar 76

VITTIKH, V. A., and SERGEYEV, V. V., Kuybyshev Aviation Institute

[Abstract] Considered here is a method of image compression of two-dimensional communications which is based on prediction taking into account the two-dimensional character of data correlation, and on subsequent adaptive discretization of the prediction error. The authors examine the structural scheme of a system of data transmission which is based on the given method, and construct a model which confirms the high efficiency of the system. The method is found to be more effective than the usual one-dimensional method over a wide range of errors, and to be so even in its simplest form. Figures 2; references 4 (Russian).

USSR

UDC 656.25:621.315.2

LAYING THE COMMUNICATIONS CABLES AND THE SIGNALIZATION, CENTRALIZATION AND BLOCK SYSTEMS UNDER THE NATURAL CONDITIONS OF THE BAM

Moscow AVTOMATIKA-TELEMEKHANIKA-SVYAZ in Russian No 12, 1976 pp 33-34

GAVRILYUK, V. V., Senior Scientific Coworker TsNII MPS [Central Scientific Research Institute, Ministry of Railroads, USSR], candidate of technical sciences

[Abstract] In 1975 a study was made in the region of construction of the BAM [Baykal-Amur Main Route] of experience in laying, installing and operating the main communications cables and the signalization, centralization and block system (SCB) cables under conditions of permafrost and low temperatures on the Transbaykal Railroad, and on the cable long-line of the Ministry of Communications running in this area. A brief discussion and analysis of this experience is presented as applied to the conditions of the construction and the forthcoming operation and maintenance of automation, SCB and

communications cable lines on the BAM. Standard rubber inserts are unsuitable for sealing the low-ground devices (the cable boxes, junctions and cross connections) under low temperature conditions as a result of increased rigidity. The following factors affect the cables at low temperatures and under permafrost conditions: permafrost soil phenomena, the thermal regime of the ground at the depth the cables are laid, and severe thunderstorm activity during the summer. Under the conditions of the BAM the following recommendations are made for laying the communications and SCB cables: laying in the ground using a knife-type cable layer on caterpillar tracks, laying by means of a rail-type cable layer on a stabilized dirt roadbed with no less than 0.8 meters upper layer of drained soil, laying in special small reinforced concrete chutes installed in the body of the dirt roadbed, and in the shoulder or replaced soil.

USSR

UDC 621.314.631

ENERGY BALANCE IN PIEZOELECTRIC TRANSDUCERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 118-125  
manuscript received 14 Nov 75

PAVLENKO, O. G.

[Abstract] The energy balance in a conservative model of a piezoelectric medium, with negligible thermal effects in the quasi-static approximation, is compared with the energy balance according to phenomenological theories of a piezoelectric transducer. Eventually the energy balance is expressed in terms of electromagnetic field energy and mechanical work, rather than being referred to the mass of the medium, for the purpose of calculating the transducer impedances. The author thanks K. M. Polivanov for discussion of this work. References 16: 5 Russian, 11 Western.

USSR

UDC 621.372.632

ANALYSIS OF WIDE-BAND NONREGENERATIVE PARAMETRIC FREQUENCY CONVERTERS FOR DECIMETER AND CENTIMETER WAVELENGTHS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 159-168  
manuscript received 2 Oct 75

BOBROV, P. P., VORSIN, N. N., MIROVSKIY, V. G., MIKHAYLOVA, E. A., and ETKIN, V. S.

[Abstract] A drawback of modern wide-band transistor devices for decimeter and centimeter wavelengths is their high noise temperature. The use of parametric low-to-high frequency converters followed by a low-noise amplifier in the input stage of receivers eliminates this problem. The design of such a converter is analyzed here on the basis of its equivalent circuit and practical means of widening its passband by insertion of filters are discussed. Because the use of matching filters is limited on account of more stringent gain considerations, classical methods of synthesis are not applicable in this case and methods of structural synthesis are followed instead. The problem is treated as one of optimization and is solved with the aid of a digital computer. A few experimentally built converter prototypes are shown and their performances is described as closely approaching the theoretical guidelines. Figures 4; tables 2; references 6: 5 Russian, 1 Western.

USSR

UDC 538.574.6

A METHOD OF SOLVING OUTER-DOMAIN TRANSIENT PROBLEMS CONCERNING THE DIFFRACTION OF ELECTROMAGNETIC WAVES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 22 No 1, Jan 77 pp 10-14  
manuscript received 14 Nov 75

MAYERGOYZ, I. D.

[Abstract] The diffraction of an electromagnetic wave at the smooth surface of an ideally conducting body is considered, and the corresponding boundary-value problem is solved for the outer (infinitely large) domain. It is an overdeterminate in terms of three unknown functions having to satisfy four independent partial differential equations, but its boundary conditions are underdeterminate. For obtaining a numerical solution, this problem is reduced here to one for an inner domain with the necessary extra boundary condition added and with the number of equations equal to the number of unknown functions. Such a conversion facilitates the solution by numerical methods: e.g., the method of grids with an explicit scheme. The fictitious outside boundary surface may be located almost anywhere, but should not lie too close to the body surface. The overall procedure becomes much simpler in the case of a plane wave, but the Kirchhoff equation must then be modified to account for diffraction at the trailing edge of such an electromagnetic wave. Figures 1; references 2 (Russian).

USSR

UDC 538.574.6

DIFFRACTION OF A PLANE INHOMOGENEOUS WAVE BY A SEMI-PLANE

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 12, 1976 pp 1854-1861  
manuscript received 14 Jan 76

SHEVERNEV, V. I., Institute of Atmospheric Physics, Academy of Sciences, USSR

[Abstract] Vectors of magnetic and electric fields of a diffracted wave are shown. The asymptotic behavior of the solution was analyzed. Estimated data on a magnetic wave field near the plane are compared with the results of calculations for diffraction of a homogeneous wave. The author thanks G. V. Rozenberg who directed attention to this problem, and V. M. Ponomarev for assistance in making calculations on an electronic computer. Figures 5; references 12: 7 Russian, 5 Western.



USSR

UDC 538.574.6

DIFFRACTION OF A PERIODIC STRUCTURE FORMED BY CONDUCTING SEMIPLANES OF  
FINITE THICKNESS

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 12, 1976 pp 1848-  
1853 manuscript received 20 Nov 75

ZHURAV, S. M., Institute of Radio Engineering, Academy of Sciences, USSR

[Abstract] The problem is considered of radiation of linearly-phased TEM waves from an infinitely periodic structure formed by conducting finite-thickness semiplanes, where the interstitial space is filled with a uniform dielectric medium. The solution is based on the Wiener-Hopf method and separation of additional regions. The problem reduces to one infinite system of linear equations which is approximately solved by the reduction method. Figures 5; references 4: 3 Russian, 1 Western.

USSR

UDC 550.388.2:551.594.6

EMISSION OF SPIRAL WAVES IN MAGNETICALLY ACTIVE PLASMA BY DISTRIBUTED SOURCES

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA No 8, 1976 pp 1121-1129 manuscript received 22 Apr 75

DOKUCHAYEV, V. P., TAMOYKIN, V. V., and CHUGUNOV, YU. V., Radiophysics Scientific Research Institute

[Abstract] The emission of electromagnetic waves in the whistling atmospheric range (spiral waves) by distributed sources (electrical, and magnetic dipoles and quadrupoles) is investigated. The total emitted power, under set conditions, is resonant in nature. Simple formulas are derived for evaluating emitting power. The propagation of electromagnetic waves in a cold magnetically active plasma may be described by the tensor of dielectric permeability. The authors thank A. A. Andronov and N. G. Denisov for discussion of the results of the work. References 18: 15 Russian, 3 Western.

USSR

UDC 551.510.35

INFLUENCE OF GEOMAGNETIC ACTIVITY ON RADIO WAVE PROPAGATION AT HIGH LATITUDES

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 12, 1976 pp 1807-1809 manuscript received 27 Nov 75

BLAGOVESHCHENSKAYA, N. F., and BLAGOVESHCHENSKIY, D. V., Siberian Institute of Terrestrial Magnetism, Ionosphere and Radio wave Propagation

[Abstract] The influence of magnetic activity on shortwave signal transmission along aurora and sub-aurora paths is examined for different seasons. The dynamics of the time-change of the mean signal levels as a function of magnetic activity in Q indices along radio paths situated along and across the aurora region and on the sub-aurora path toward the meridian are analyzed. The working frequencies at paths 1, 2, and 3 were: 9-11 MHz, and 5-7 MHz. A Minsk-22 computer was used to determine the mean signal values. As magnetic activity increases during daylight hours of winter, the mean values of signals decrease in both aurora and sub-aurora paths because of increased absorption and destruction of reflective layers. At night two peaks are generally observed in the curves of the mean signal level versus magnetic activity. Figures 2.

USSR

UDC 621.371.25

FORESHORTENING SCATTERING OF SHORTWAVE RADIO SIGNALS BY ARTIFICIAL IONOSPHERIC IRREGULARITIES

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 12, 1976 pp 1909-1912

GETSMANTSEV, G. G., YERUKHIMOV, L. M., MITYAKOV, N. A., POLYAKOV, S. V., URYADOV, V. P., and FROLOV, V. L., Scientific-Research Radiophysics Institute

[Abstract] When the F-layer of the ionosphere is affected by powerful radio emission irregularities arise in the plasma with a wide spectrum of scales. A 130 kW radio transmitter operating at a frequency of 4.62 MHz was used to perturb the ionosphere. The antenna was vertically directional. The perturbed region was diagnosed by emission of carriers from remote stations from azimuths of 69° and 75° at 13.2 and 18.8 MHz. The authors thank N. P. Ben'kov for assistance in organization of the experiment, and P. P. Beyayev, Yu. D. Vdovin, V. S. Karavanov, and A. V. Rakhlin for participation in preparation of the equipment for the expeditionary point. Figures 3; references 5: 2 Russian, 3 Western.

USSR

UDC 621.371.25

ANALYSIS OF THE TOTAL SHORTWAVE FIELD OF RADIOWAVES AT SIGNIFICANT DISTANCES  
BETWEEN RECEIVER AND TRANSMITTER

Gor'ky IZVESTYA VUS: RADIOFIZIKA No 8, 1976 pp 1114-1120 manuscript received  
20 Oct 74; after completion 21 Oct 75

GOTSAKOVA, L. S., GROMNITSKIY, V. S., and YASHIN, YU. YA., Gor'ky State  
University

[Abstract] The problem of determining the full field of signals in the short-wave range is examined for the case of multi-skip propagation in the plane of a large circle and at a given distance between transmitting and receiving points. The model is a multilayer quasiparabolic isotropic ionosphere, whose center of curvature is displaced from the Earth's center. Ionospheric absorption and attenuation of the signal reflected against the earth are taken into account. Figure 1; table 1; references 7: 5 Russian, 2 Western.

USSR

UDC 621.371.33

AN ENGINEERING METHOD OF CALCULATING THE ROTATIONAL COMPONENT OF THE  
DIELECTRIC CONSTANT OF WATER VAPOR FOR  $\lambda \geq 0.33$  MM WAVELENGTHS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 176-178  
manuscript received 20 Oct 75

ZRAZHEVSKIY, A. YU., and MALINKIN, V. G.

[Abstract] A transition from centimeter to millimeter and submillimeter wavelengths in the atmosphere is accompanied by a dispersion of the refractive index of air, because then there takes place an anomalous dispersion of the rotational components of the dielectric constant of the water vapor in the atmosphere. The quantum-mechanical method of calculating this component is unwieldy, because the slopes of many resonance lines must be taken into consideration and each is determined by several parameters. An engineering method is proposed here where  $\epsilon_{\text{rot}} - 1 = (\epsilon_1 - 1) + (\epsilon_2 - 1)$ .

Only the first term, representing the longer wavelengths, is calculated simply according to the quantum-mechanical expression. The second term, representing the shorter wavelengths, is calculated by an empirical approximate expression which has been derived from available data. The results agree within 1.2% with earlier calculations for the centimeter band and should be within 3.5% of measurements in the ranges of anomalous dispersion. The authors thank M. A. Kosolov, A. V. Sokolov and K. A. Aganbekyan for discussion of the results of the work, and V. F. Murashov for assistance in making calculations on an electronic computer. Table 1; references 7: 3 Russian, 4 Western.

## REFLECTION OF RADIOWAVES FROM VARIOUS LAYERS OF THE IONOSPHERE

Moscow AVTOMATIKA-TELEMEKHANIKA-SVYAZ in Russian No 12, 1976 pp 16-17

VOLKOV, A. A., dotsent MIITa [expansion unknown], candidate of technical sciences

[Abstract] The reliability of nation-wide short-wave radio communications is determined to a great degree by the signal-to-noise ratio at the receiving end. It is known that the higher the operating frequency the lower the noise level in the communications channel. From this point of view reflection from a layer of the ionosphere with the greatest maximum frequencies can be considered to be the most efficient. Graphs are presented for the maximum usable frequencies of the E, F1 and F2 layers of the ionosphere and the angles of radiation  $\Delta$  as a function of the length of the radio path R in accordance with the forecasts of the Institute of Terrestrial Magnetism of the Ionosphere and Radiowave Propagation, Academy of Sciences, USSR, for June-July 1972 for 55° to 65° north latitude. The field intensity was calculated for middle geomagnetic latitudes. On being reflected from the E-layer of the ionosphere, the beams are absorbed only in the two D and E layers of the ionosphere, and on reflection from the F2 layer, in four layers: D, E, F1 and F2. However, for the optimal radiation angle, in both cases the field intensities at the reception point are identical in practice. The greatest maximum usable frequencies will occur on reflection from the E layer and with a path length  $R > 700$  km. Considering the greater stability of the parameters of the E layer and the greater magnitude of its maximum usable frequencies in comparison with the other layers, in the summer, for lines more than 700 km long it is possible to state that the signal-to-noise ratio at the reception point is greater when working from the E layer than when working from the F2 layer. This was confirmed experimentally.

USSR

UDC 53.084.2.019.3.001.24

CALCULATED AND EXPERIMENTAL EVALUATION OF THE MECHANICAL RELIABILITY OF SENSORS

Moscow PRIBORY I SISTEMY UPRAVLENIYA No 11, 1976 pp 24-26

OSADCHIY, YE. P., doctor of technical sciences, KARPOV, V. I., candidate of technical sciences, and PEDORENKO, N. P., engineer

[Abstract] Reliability requirements placed on sensors have sharply increased. Particular attention is being directed toward immunity of sensors to damage (or destruction) in cases where they comprise elements of equipment whose parameters are subject to measurement. The calculated evaluation of mechanical reliability in sensors is based on the use of the deterministic method of strength reckoning for the corresponding design elements of the sensor, and on a knowledge of the static characteristics of the strength properties of the materials used in the design; also, on the limiting characteristics of the active loads imposed. The experimental evaluation is based on the use of decisive tests carried out on a previously determined number of sensors for a given level of confidence. Table 1; references 11 (Russian).

USSR

UDC 531.71.084.2

MAGNETICALLY-SUSPENDED DIFFERENTIAL TRANSFORMER SENSORS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1976 pp 37-38

ABDULLAYEV, YA. R., candidate of technical sciences, and GERAS'KOV, V. L., engineer

[Abstract] Differential transformer sensors are suspended in a magnetic field. This avoids friction between moving and stationary parts, increasing sensor accuracy and permitting the measurement of small force quantities (about  $10^{-1}$  gram) and motion. Moving elements are Cu or Al short-circuited frames. Change in the output curve of the sensors is achieved by changing the air gap by moving the magnetic circuit armature. Sensors use Al screens which are lighter than Cu ones of the same electrical resistance. Technical specifications are as follows:

$V_{CC} = 36-220$  VAC, 50 Hz  
Sensitivity 1 V/mgs  
Movement 2-10 mm  
Measurable force  $10^{-1}-10^{-3}$  gauss.

Figures 2; reference 1.

USSR

UDC 535.8:535.214.4

SIX-CHANNEL RADIOMETER FOR SPECTRAL INVESTIGATIONS OF TERRESTRIAL AND PLANETARY ATMOSPHERES

Gor'ky IZVESTIYA VUZ: RADIFIZIKA in Russian Vol 19 No 12, 1976 pp 1795-1799  
manuscript received 27 Oct 75

BUROV, A. B., VORONOV, V. N., KRASIL'NIKOV, A. A., and SEROV, N. V., Scientific-Research Radiophysics Institute

[Abstract] A 3-4 mm spectrum analyzer with five narrow channels of 80 MHz width each and one wide channel of 1,000 MHz is described. Radiometer fluctuation sensitivity in the wide channel is equal to 0.5 K and in the narrow one is 1.5-2 K with a time constant of 1 second. A highly stable heterodyne with relative frequency instability less than or equal to  $10^{-6}$  is used in the receiver. The device includes a directional coupler, noise generator, IF amplifier, two-part coaxial resonator filter. Figures 4; references 9 (Russian).

USSR

UDC 621.317.06

DISTORTION OF TELEMETRY BY SLUGGISH THERMAL SENSORS AND OPTIMAL CORRECTION OF DYNAMIC ERROR

Novocherkasska IZVESTIYA VUZ: ELEKTROMEKHANIKA in Russian No 12, Dec 76  
pp 1318-1322 manuscript received 6 Sep 74; after completion 24 Mar 75

MOKIN, BORIS IVANOVICH, candidate of technical sciences, dotsent, Vinnitskiy Polytechnical Institute

[Abstract] Research has shown that even stabilized time-temperature relationships are stationary random processes with a deviation inverse to the depth of stabilization. Therefore, distortions in telemetry should be analyzed mean-quadratically. Methods are proposed for evaluation of the distortion of thermal sensor elements caused by sluggishness. If measurements are made in the presence of noise, a decrease in the time-constant of the thermal converter will not always reduce dynamic measurement error. A method is proposed for determining the optimum value of system coefficients, including correction factors for lag properties of thermal sensors. Sluggishness factors of electronic links of the thermal converter are ignored in calculations because they are three or more orders less than the thermal sensor lag. References 7 (Russian).

USSR

UDC 621.317.31:537.525.5

THE MEASUREMENT OF HIGH CURRENT DENSITIES IN THE CATHODE SPOT OF AN ARC DISCHARGE

Moscow IZMERITEL'NAYA TEKHNIKA No 1, 1977 p 69

RAKHOVSKIY, V. I.

[Abstract] Use of the concept shown in the literature of the cathode spot as a continuous sequence of explosions in order to describe a rapidly varying cathode spot, leads to essential contradictions. It is clear that two stages in the existence of a spot should be distinguished: 1) The initial stage, in which, after about  $5 \cdot 10^{-8}$  sec the explosion occurs, and the plasma of the cathode spot is formed, while the current emitted advances into the weakly ionized residual plasma, usually at the boundary of the extinguishing spot, at which time the current density falls off rapidly; and 2) In proportion to the dispersion of the spot plasma after about  $10^{-5}$  sec, the stage at which the density of the current emitted slowly, this being accompanied by an increase in the voltage drop leading ultimately to a new explosion and to the formation of a new spot. References 10: 9 Russian (Some in English), 1 Western.

USSR

UDC 621.317.725

MULTIPLE-CHANNEL CONTINUOUS-VOLTAGE MILLIVOLT MEASURING CONVERTER

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1976 pp 39-40

VASIN, N. N., IOFFE, V. G., engineers, BOLTYANSKIY, A. A., PSYEHNICHNIKOV, YU. V., and SKOBELEV, O. P., candidates of technical sciences

[Abstract] The use of commutation methods of conversion in the design of assembly systems not only ensures switching of low-level signals, but also avoids the need for amplifiers and power sources, because conversion occurs as a result of signal energy developed in the sensor itself. The converter is designed to operate with generator-sensors, e. g., thermocouples, which have an output signal of 0-50 mV. Sensitivity  $S = 100$ . Error 0.2%. Temperature error 0.1%/10°C from -60°C to +60°C. The output is fed to a computer (alternative channel interrogation mode) or to a 4-bit decade display (channel monitoring mode). Figures 2; references 3 (Russian).

USSR

UDC 621.317.725.024.083.92

# A HIGH-SPEED DIGITAL DC VOLTMETER

Moscow IZMERITEL'NAYA TEKHNIKA No 1, 1977 pp 65-66

NAGAYKIN, A. S., YEREMINA, G. I., GORDIYENKO, A. M., and TORCHIN, A. L.

[Abstract] The speed of measuring voltage in many cases has some effect on the completeness of information concerning processes recorded by electronic devices. The authors have developed a high-speed digital voltmeter with a brief measurement time. This new digital voltmeter offers a three-value indication of the measured voltage and also an indication of its polarity. The time of a single measurement is not more than 20 microseconds. The measurement error does not exceed 0.5%  $\pm$  1 signs within the temperature range of 20  $\pm$  10°C. Information on the results of measurement is stored until the next start-up pulse. The apparatus has two ranges for the measurement of input voltages: 0-1,000 mV with discreteness of 1 mV, and 0-100 mV, with discreteness of 0.1 mV. Figures 1; references 3 (Russian).

USSR

UDC 621.317.799:538.56

# HIGH FREQUENCY CAPACITANCE SEMICONDUCTOR RESISTIVITY METER

Riga IZV. AKA. NAUK LATVIYSKOY SSR in Russian No 9, 1976 pp 80-81 manuscript received 27 Apr 76

AL'YENA, O. K., GRIGULIS, YU. K., DZILUMS, K. A., Physics and Energy Institute, Academy of Sciences, Latvian SSR

[Abstract] Optical, mechanical and chemical methods are now used to monitor the parameters of semiconductors. These methods are unsatisfactory if they must be used during operation and require physical contact. Inductive methods are used with the VYeIS-1P (high frequency capacitive resistivity meter). Its operation is based on measurement of the components of total conductivity of a capacitance measuring element in whose field the test specimen is situated. A voltage divider with 2 inductances is incorporated. The frequency oscillator operates in the 150-200 MHz range. The output voltage booster is a MP42B solid-state triode. The measured resistivity of semiconductor chips of 0.3-2 mm diameter is 20-500  $\Omega$ .cm. Error  $\pm$ 10%. Weight 6 kg. The device is now in use at the Special Design and Technological Office of Nonstandard Equipment (Molodechno, Belorussian Soviet Socialist Republic). Figures 1; references 1 (Russian).



LATVIA

UDC 621.317.799:538.56

DEVICE FOR MONITORING THE PROPERTIES OF NICKEL FILMS ON SILICON

Riga IZV. AKAD. NAUK LATVIYSKOY SSR in Russian No 9, 1976 pp 78-80

GRIGULIS, YU. K., PORIN'SH, V. M., and SOKOV, V. A.

[Abstract] Nickel contacts are used for resistance contacts in silicon semiconductor power structures and for planar structures. A special device has been developed, the VITN-2P (modification of the VIGP-1F) which has increased sensitivity. It can monitor Ni film thickness of 0.5-5 microns. Contact-free monitoring ensures testing during operation, with no damage to components. The device is currently used at the Tallin Electrotechnical Plant. Figures 3; reference 1 (Russian).

USSR

UDC 621.374.323:681.327

# DECIMAL COUNTERS BASED ON HYBRID INTEGRAL MICROCIRCUITS

Moscow PRIBORY I SISTEMY UPRAVLENIYA No 11, 1976 pp 44-45

SHURYGIN, I. T., candidate of technical sciences, and NOVIKOV, L. G., engineer

[Abstract] A number of means exist for the construction of decimal counters, but most of these deal with measured pulses by employing duodecimal codes which can be applied only with difficulty in the construction of decimal arithmetic devices. In the interest of combining pulse counters with small keyed electronic computers, it is of value to construct decimal counters which work in duodecimal codes already in use with small decimal computers--namely the Stibits and the 8-4-2-1 codes. The authors developed pulse counters based on the DTL IS hybrids, which employ the above codes. The basis of these counters consists of a four-discharge binary counter, based on microcircuits of type 2TK171; these, in the general case, can be constructed as functions of a D-trigger or as functions of an RST trigger. The counters differ from one another, depending on how the initial (zero) code combination is set up, and also by the sign according to which this code combination is established. Each, therefore, has its own area of application.

USSR

UDC 621.374.383

# A SYMBOL-RECOGNITION DEVICE FOR READING FREQUENCIES

Moscow PRIBORY I SISTEMY UPRAVLENIYA No 11, 1976 pp 43-44

KREMNEVA, T. I., engineer

[Abstract] A symbol-recognition device for reading frequencies has been developed on the anticoincidence principle, with use of a discrete filter; it is built upon microcircuits like those of the "Logika-2" and the "Funktsiya-3." The frequency-reading device will determine the difference of two pulse sequences  $F_1$  and  $F_2$  which vary independently of each other in any frequency ratio, and within the limits of a given working range. The pulses may be distributed unevenly. The operation of the device has already received experimental verification within the temperature range of 5-60° C, with variation of  $\pm 5\%$  in the supply voltage within the range of variation of input frequencies from 0 to 300 kHz. Figures 3; reference 1 (Russian).

## INFORMATIONAL PROPERTIES OF AN AUTODYNE VELOCITY MEASURER

Moscow RADIOTEKHNIKA in Russian Vol 32 No 1, 1977 pp 65-69 manuscript received 24 Jun 75

STRYUKOV, B. A., and ZVEREV, YU. M.

[Abstract] When a signal is reflected on an object under observation, an autodyne may have two modes of operation according to the rate of motion of the object and its range: quasistationary, or informational; and non-stationary. The simplified autodyne velocity measurer includes a self-excited oscillator, antenna and recorder. Formulas for an equivalent circuit are given. Computerized solutions to the problem are presented. To ensure operation of the autodyne in the quasistationary mode, its parameters must be chosen so that certain correlations are satisfied, those which ensure observation of the objects at maximum ranges and velocities as defined in the article. Figures 5; references 3 (Russian).

POLAND

PROGRAMMABLE FEEDER DEVICE FOR ANODIC OXIDATION OF SILICON

Warsaw ELEKTRONIKA in Polish No 10, 1976 pp 366-368

STEPNIEWSKI, WOJCIECH and STOLARSKI, ANDRZEJ, Institute of Electronic Technology, Wroclaw Polytechnic

[Abstract] A programmable feeder device developed at the Institute of Electronic Technology of the Wroclaw Polytechnic for anodic oxidation of silicon is described. It permits the performance of Eloxal process within the current density from 0 to 6 mA and voltage from 0 to 260 V. The accuracy of stabilization and voltage is higher than 0.3%. The accuracy of reading with the aid of a built-in measuring instrument is better than 1%. Figures 3; references 3 (Polish).

USSR

UDC 621.373.8

LASER AUTOMODULATION BY MEANS OF NONLINEAR ABSORPTION FILTERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 126-134  
manuscript received 2 Oct 75

BULGAKOV, B. M., BYKOV, M. M., and OL'KHOVSKIY, I. P.

[Abstract] A CO<sub>2</sub> laser with nonlinear absorption filters is analyzed for the feasibility of automodulation. The fundamental equations describing the process kinetics in such a laser with a phototropic shutter are based on a one-dimensional single-frequency model including a three-level active medium with a metastable upper state and a two-level passive (absorbing) medium. These nonlinear differential equations are first simplified to algebraic equations of the steady state and then solved numerically by the Lyapunov method for a stability analysis. The conditions for automodulation are then established, when large pulses will be generated at a frequency which depends on variations of system parameters (gas pressure, geometrical dimensions, etc.), and the original equations are solved with the aid of approximating functions. Methods of frequency control such as forced synchronization, for example, and the phenomenon of hysteresis are also discussed here. Figures 6; references 12: 4 Russian, 8 Western.

USSR

UDC 621.373.8

PERFORMANCE OF A TRAVELING-WAVE LASER WITH PERIODICALLY VARYING RESONATOR PARAMETERS. FAST ROTATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 135-140 manuscript received 3 Oct 75

KHOSHEV, I. M.

[Abstract] A traveling-wave laser is considered with quasi-periodically varying resonator parameters: the coupling coefficients and the frequencies of two oppositely traveling waves. The performance of such a laser is analyzed for the case of a large (relative to the locking band) constant component of the frequency difference, which corresponds to natural operating conditions. A variant of the averaging method, characterized by simplicity and generality, reduces the fundamental equations of a periodically perturbed system to independent equations of the same form as those of an unperturbed system. The synchronization band can now be easily calculated for any mode of modulation. The results apply also to high-frequency modulation. The author thanks I. P. Mazan'ko for constant attention to the work. References 10: 9 Russian, 1 Western.

USSR

UDC 621.371.3.029.7

CHANGE IN THE TRANSPARENCY OF AN AQUEOUS WHICH IS CLEARED BY A CO<sub>2</sub>-LASER BEAM  
AT THE WAVELENGTHS OF 0.63 AND 1.06 MICROMETER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 207-212  
manuscript received 23 Dec 75

GORDIN, M. P., SOKOLOV, A. V., and STRELKOV, G. M.

[Abstract] For a comparative analysis of illuminating and probing radiation through evaporating polydisperse aqueous aerosols, first the time-radius characteristics of volumetric attenuation were determined with probing laser beams at the wavelengths 0.63 and 1.06 micrometer as well as with an illuminating laser beam at the wavelength 10.6 micrometer. A model of the probing process could thus be constructed, the transparency coefficients in either case calculated, and the conditions of transmission, with a possible delay of one beam, evaluated. Figures 3; table 1; references 27: 18 Russian, 9 Western.

USSR

UDC 621.382.82.001 + 681.3.06

EMPLOYMENT OF BOOLEAN ALGEBRA IN DESIGNING TOPOLOGY OF LARGE-SCALE INTEGRATED CIRCUITS

Kiyev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5(25) Sep/Oct 76 pp 119-122 received 28 Sep 75; after completion 21 Feb 76

RUBTSOV, VALERIY PAVLOVICH, engineer Kiyev, ZIZHKO, VLADIMIR ABRAMOVICH, engineer Kiyev, and TKACHENKO, YURIY IVANOVICH, engineer Kiyev

[Abstract] A method is considered for formalization and preparation of a mathematical model of the layout of interconnections of large-scale integrated circuits (LIC) within a system of automatization of design of the topology of LIC with the aid of the apparatus of the algebra of logic and logical equations. The following are included in the discussion: 1) Concept concerning switching circuit; 2) Mathematical model of switching circuit; 3) Synthesis of topology; and 4) Possibilities and field of application. The method of generation of topology described can be used both independently during construction of the logical core of digital LIC and in a complex with other methods, e.g., during development of a topological unit of a structural method or the method of cells. Figures 5; references 7: 6 Russian, 1 Western.

USSR

UDC 621.382.233

SYNTHESIS OF INTEGRATED COMPLEMENTING FLIP-FLOP DEVICES WITH COUNTING INPUT

Kiyev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5(25) Sep/Oct 76 pp 106-110 manuscript received 9 Dec 75; after completion 4 Mar 76

KLIMOV, VALENTIN VIKTOROVICH, candidate of technical sciences, Institute of Mining, Ministry of Ferrous Metallurgy, USSR (Sverdlovsk)

[Abstract] Methods are presented for synthesizing a complementing flip-flop device with a counting input. The work is based on the use of R-S flip-flops, combined either with pulse switches which store the control signal or with interlocked triggers. Circuit diagrams of the following are shown: 1) Pulse switch, storing control signal, RTL system; 2) Pulse switch, storing control signal, based on tunnel diodes and transistors; 3) Pulse switch, storing control signal, based on devices with S-shaped volt-ampere characteristics; 4) Blocked trigger (d-trigger), RTL system; 5) d-trigger of TTL system; 6) d-trigger based on tunnel diodes and transistors; 7) d-trigger based on tunnel diodes and transistors with emitter followers between a Go To and transistor pair connected in a circuit with a common base; and 8) J-K flip-flop of TTL type with d-trigger of TTL system. Figures 11; references 13 (Russian).

## MODULATION AMPLITUDES METHOD AND ITS APPLICATION TO MICROWAVE ELECTRON DEVICES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 141-152 manuscript received 22 Jul 75

GAYDUK, V. I., and AFANAS'YEVA, T. B.

[Abstract] An electron beam is regarded as a continuum and the modulation amplitudes of nonlinear waves in gyroelectron devices are determined as the Fourier coefficients in the periodic solution to the equations of motion of an electron with an arbitrary trajectory, after these equations have been reduced to canonical form. With the components of the h-f Lorentz force in a cylindrical system, the instantaneous and the mean energy of an electron as well as the amplitude of momentum modulation and the amplitude of phase modulation are calculated as functions of the longitudinal coordinate at 0.95 synchronization. The mean electron efficiency is calculated as a function of the amplitude of the microwave field intensity at 0.98 synchronization. The longitudinal momentum profile is calculated by the same method of modulation amplitudes as well as according to the conventional (averaged) equations of motion, the latter being preferable for finding the "real" trajectories of electrons. Figures 5; tables 2; references 15 (Russian).



USSR

UDC 621.383.2

## AN OPTICAL TARGET COORDINATOR

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR Vol 29 No 4, 1976 pp 55-58  
manuscript received 19 Jun 75

GULGAZARYAN, K. A.

[Abstract] Familiar types of target coordinators are usually constructed on the basis of industrially produced photomultipliers, with the use of rotating disks; or else on the basis of special coordinate-sensitive multipliers. Here the author considers the radiation from the object of an optical lens system, which is divided into four parts, each of which is focused on various areas of a photocathode. A square screen is so set up within the focal plane that in the normal position half of each of the light fluxes falls on the screen. For shaping the signal, the currents produced by the light flows are modulated by external lateral electrodes. The design of the external electrodes, which assures deep modulation of the fluxes as well as minimal effect from the modulating fields on the neighboring photoelectron fluxes, is given. It is shown that the device is at least as adequate as the familiar square type of photomultiplier. Figures 3; references 4 (Russian).

USSR

UDC 621.383.4:53.088.223

## THE EFFECT OF TIME LAG IN PHOTORESISTORS ON THE OPERATIONAL ACCURACY OF AUTOMATIC DEVICES

Moscow PRIBORY I SISTEMY UPRAVLENIYA No 11, 1976 pp 46-47

BOGDANOV, E. O., candidate of technical sciences

[Abstract] Photoresistors are now being widely used in control-and-sorting automats, where they function as elements of the threshold circuit, which transforms continuous information on the size of the controlled part into discrete information on the number of the sorting group. In one improved threshold circuit, each cell, consisting of 1 photoresistor and 1 actuator, corresponds to a series of definite dimensions of controlled manufactured parts comprising a sorting group. When the part is in the measuring position, the light index of the illuminator of the photoresistor converter occupies a strictly fixed position, and illuminates two photoresistors simultaneously. With dimensions of the parts corresponding to the boundary of two neighboring sorting groups, the center of the light index is found between the two neighboring photoresistors. Tests conducted by the Leningrad Instrument Plant have completely confirmed previous theoretical research in this area, and made it possible to develop and put to use in automatic devices, such photoelectric converters of increased accuracy. Figures 1; references 2 (Russian).

USSR

UDC 62-50

ON SENSITIVITY OF MOTION PARAMETERS OF AN OBJECT TO ERRORS IN INERTIAL SYSTEM OF NAVIGATION AND CONTROL

Kiev AVTOMATYKA in Ukrainian No 6, Dec 76 pp 47-54 manuscript received 24 Feb 75

LEBEDEV, D. B., Institute of Cybernetics, Academy of Sciences UkrSSR

[Abstract] The interest in inertial navigation systems can be explained by their significant advantages, such as their universality and autonomy, over other navigation systems. Utilization of inertial systems in combination with computers in controlling moving objects opens great possibilities in the design of flexible and highly accurate control algorithms. A study was made of the effect of errors of starting conditions of the object motion, errors of sensitive elements orientation, and the presence of a non-sensitivity zone in their characteristics on the process of controlled motion of an object in a closed system consisting of a control object and inertial system of navigation and control. Several equations have been derived which allow the formulation of conditions for the starting set up of an inertial system of navigation, evaluation of tolerances for the set up of sensitive elements, and evaluation of magnitude of allowable non-sensitivity zones of their characteristics. Figures 3; references 5 (Russian).

USSR

UDC 621.391.164.6

DETECTION OF A RADAR TARGET IN THE CASE OF INCOHERENT ACCUMULATION OF SIGNALS AND THEIR FAST FLUCTUATIONS

Moscow RADIOTEKHNIKA in Russian Vol 31 No 12, 1976 pp 18-22 manuscript received 16 Dec 75

BILETOV, M. V., VASSERSHTEYN, I. S., and CHESNOKOV, V. A.

[Abstract] A study is made of the effect of the depth of the fluctuations of the echo intensity on the magnitude of the probability of target detection with incoherent accumulation of a bundle of  $N$  pulses after the quadratic detector. In the general case the form of the detector is indifferent, but in the investigated case it is possible to obtain the required results using simpler analytical relations. In calculating the probability of the target detection by the bundle of incoherent pulses it is necessary to know the distribution law of the envelope of this bundle for fast fluctuations of the envelope with amplitudes of each pulse with respect to a logarithmically normal law.

The results of calculating the detection curves by the derived formula are given for various values of the depth of fluctuations of the envelope of the amplitudes of the echoes and two values of the number of accumulated pulses ( $N = 10$  and  $20$ ). In the range of values of the signal-to-noise ratio  $Q$  less than 6 decibels (for  $N = 10$  pulses) and less than 3 decibels (for  $N = 20$  pulses) the target detection probability depends little on the variation in depth of the fluctuations of the amplitude envelope of the echoes. In the range of values of  $Q$  greater than 6 decibels (for  $N = 10$  pulses) and  $Q$  greater than 3 decibels (for  $N = 20$  pulses) the probability of detection depends on the depth of the fluctuations of the echoes.

A decrease in depth of the fluctuations leads to an insignificant decrease in the probability of detection in the range of small values of the signal-to-noise ratio and an increase for the medium and large values. An increase in the number of accumulated pulses (e.g., from 10 to 20) leads to a decrease in the effect of the depth of the fluctuations on the probability of the target detection for the large values of the signal-to-noise ratio because the partial compensation from the individual signals by each other begins to be felt.

The variation of the magnitude of the coefficients of asymmetry and excess as a function of the signal-to-noise ratio is of a nonmonotonic nature. In the investigated range of values of the signal-to-noise ratio the coefficients of asymmetry and excess are greater than 0.1. Accordingly, to decrease the error in calculating the probability of detecting signals reflected from the target it is necessary to introduce a correction to the normal law by using several first terms of the expansion of the distribution function of the sum of the independently fluctuating pulses in a series with respect to Hermitian polynomials.

A comparison is made between the detection codes for the logarithmically normal distribution law of the fluctuations of the echo envelope and the fluctuations of the envelope of the incoherent bunch with respect to the  $X^2$  law. Figures 4; references 8 (Russian).

USSR

UDC 621.396.677:621.396.96

#### CALCULATION OF THE DEPOLARIZING PROPERTIES OF RADAR TARGETS

Moscow RADIOTEKHNIKA in Russian Vol 31 No 12, 1976 pp 3-6 manuscript received 18 Mar 75

ZHIVOTOVSKIY, L. A.

[Abstract] A procedure is proposed for representation of the depolarizing properties of targets which facilitates calculation of the parameters of the echoes for any polarization of the radar radiation. The representation obtained for the field of the echoes in the form of the sum of the fields of several uncoordinated waves permits easy determination of the signal power in the load of the receiving antenna with given polarization. A formula is presented for calculating the power of the received signals.

The signal field for the echoes from radar targets can be represented in the form of an additive sum of the unpolarized waves and the four noncorrelated polarized waves; the representation on a Poincare sphere is fixed and can be considered as the polarization "portrait" of the target. This representation of the depolarizing properties of the target facilitates analysis of the parameters of the echoes for various polarizations of the radar radiation, and it can be used in solving many radar problems. Figures 2; references 5 (Russian).

USSR

UDC 621.396.966.1

SYNTHESIS AND AN ANALYSIS OF THE DISCRIMINATORS OF THE TRACKING TIME DELAY MEASURER OF A LIGHT LOCATION SIGNAL IN A PROTON COUNTING REGIME

Moscow RADIOTEKHNIKA in Russian Vol 31 No 12, 1976 pp 28-32 manuscript received 10 Dec 75

PAVLOVA, G. YA.

[Abstract] Optimal and quasioptimal discriminators are calculated in investigating the problem of range measurement and tracking of a remote light source under certain assumptions regarding the reception of the pulse signal, the intensity of the useful light signal and the fact that the post-detector processing of the light location signals is conducted using a receiver with direct photodetection that is inertialless, which means that the single electron pulses are reliably resolved in time. The fluctuation characteristics of the optimal and the quasioptimal discriminators are compared. From the comparison of the optimal and quasioptimal discriminators it follows that the error in measuring the delay time of the light location signal of the quasioptimal discriminator for  $\Delta = 0$  ( $\Delta$  is the mismatch) and  $\rho = 0.1$  ( $\rho$  is a value proportional to the pulse energy provisionally called the pulse amplitude) is larger than the optimal error by approximately 1.3 times. With an increase in the amplitude of the useful signal the errors in measuring  $\tau$  of the investigated discriminators approach each other for null mismatch. Figures 3; references 2 (Russian).

USSR

UDC 621.396.59

GEOMETRIC INTERPRETATION OF A VARIATION RECEIVER

Moscow RADIOTEKHNIKA in Russian Vol 32 No 1, 1977 pp 62-64 manuscript received 8 Dec 75

VAKUL'SKIY, A. A., MIZYUK, L. YA., and TSEMA, M. I.

[Abstract] The variation problem may be stated in geometric terms. A variation receiver is analyzed in these terms and its operating algorithms are presented. Linear functionals were the prime means of representing and processing signals. However, when extreme values of the corresponding functionals are to be found, linear functionals are not always suitable, because sometimes a signal is found whose linear functional has an arbitrary value. This problem is overcome when nonlinear functionals are used which have a maximum and minimum. The method has no constant comparison threshold. Its value is selected on the basis of analysis of the results of processing actual signals and noise. References 7 (Russian).

USSR

UDC 629.783:621.396.2

SYNTHESIS OF OSCILLATOR VOLTAGES IN SATELLITE RETRANSMITTERS

Moscow RADIOTEKHNIKA in Russian Vol 32 No 1, 1977 pp 3-10 manuscript received 28 May 76

MASHBITS, L. M., VUL'FOV, YU. D., and YANSHINA, G. F.

[Abstract] On-board frequency synthesizer(OFS) of satellite retransmitters have certain properties: 1) There are certain (2-20) simultaneous voltages generated which have different rated frequencies; 2) The size, weight and output of the power supply are under more rigid constraints; and 3) OFS must ensure trouble-free operation for the entire service period. Because frequency stability is defined by the earth-based signal source and is independent of retransmitter parameters, the OFS task is to shape 2 voltages with a frequency which would yield the required spectral shift of the output signal from the input. OFS may have separate reference oscillator in each branch, a common reference oscillator, or compensation circuit. The device is designed to generate two reference voltages with frequencies of 63.854166 MHz and 59.453125 MHz on the basis of a common reference carrier of 5 MHz. Logic phase detectors are used to isolate voltage errors. The material improvement in these methods of retransmitter design is a "direct transfer" of input signal spectrum to the retransmitter output without I.F. transition. Figures 12; table 1; references 14: 12 Russian, 2 Western.

USSR

UDC 621.382.2

THE THEORY OF AVALANCHE S-DIODES WITH SCHOTTKY BARRIER

Moscow IZVESTIYA VUZ: PRIBOROSTROYENIYE Vol 19 No 12, 76 pp 72-77 manuscript received 21 Apr 76

D'YAKONOV, V. P., Smolensk Branch of the Moscow Power Engineering Institute

[Abstract] Possible physical mechanisms involved in the rise of falling sections on the volt-ampere characteristic of p-n-transitions with a Schottky barrier in the avalanche region are described. The analysis makes possible a conclusion regarding the expedience of developing avalanche S-diodes with such a barrier. The great high-speed action, simplicity of structure and combination with the technology of monolithic integral circuits support the contention that S-diodes with a Schottky barrier are in fact promising active instruments. Figures 3; references 6 (Russian).

USSR

UDC 621.382.3

THE MOS-TRANSISTOR, A FUNCTIONAL MICROPOWER DEVICE

Moscow IZVESTIYA VUZ: PRIBOROSTROYENIYE Vol 19 No 12, 76 pp 82-84 manuscript received 11 Mar 76

IGUMNOV, D. V., TEREKHOV, V. A., and FROLOV, V. N., Moscow Institute of Radiotechnology, Electronics, and Automation

[Abstract] The authors examine the operation of a MOS-transistor during delivery of low supply voltage to the subtrek. It is shown that the transistor is a functional micropower device capable of functioning both as an inverter and as an amplifier. Figure 1; references 2 (Russian).

USSR

UDC 621.382.3:539.3

# THE NONLINEAR THEORY OF MULTICOLLECTOR TRANSISTORS

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR Vol 29 No 4, 1976 pp 45-54  
manuscript received 15 Jul 75

ARUSTAMYAN, V. YE., ERNIIMM [?Yerevan Scientific-Research Institute of  
Mathematics and Mechanics]

[Abstract] The earliest report on the possible construction and use of multicollector transistors dates from 1969, but little has been done in this area until very recently. The system of equations of a single-collector transistor is generalized here to embrace the case where the transistor structure contains a set of p-n-transitions. The author determines the parameters characterizing multicollector transistors, such as will make it possible to transform the heat-flow matrix, and thereby, also describe the functioning of the transistor by the traditional method. The case of two collectors in both static and dynamic regimes is discussed in detail, and the equivalent circuit for the active region is plotted. Figures 2; tables 2; references 6: 3 Russian, 3 Western.

USSR

UDC 621.382.019.3:621.391.822

# POSSIBILITY OF PREDICTING RELIABILITY OF VARICAPS ACCORDING TO THEIR NOISE RESPONSE CURVES

Moscow RADIOTEKHNIKA in Russian Vol 32 No 1, 1977 pp 89-91 manuscript  
received 12 May 75

KARBA, L. P., and UL'MAN, N. N.

[Abstract] Varicaps are divided into two groups according to noise parameters measured at a low frequency. Each group is given a comparative degree of reliability and possible type of breakdown. Methods are developed for detecting potentially unreliable devices according to low frequency noise. This applies to bipolar solid-state devices with a PN-junction, i.e., varicaps. The coefficient of noise,  $\gamma$ , defines the excess of noise of different origin over thermal noise of a bipole. In reverse bias, the PN-junction is one noise source. Because reverse current  $I_R$  is composed of several independent components, fluctuations in total current may be seen as a superposition of fluctuation of its components. These methods should be used for quality control prior to installation of varicaps in equipment. Examples are given for KV104B and KV106A varicaps. Figure 1; table 1; references 5: 4 Russian, 1 Western.

USSR

UDC 621.382.33.089.6-52

MEASUREMENT OF THE STATIC PARAMETERS OF TRANSISTORS DURING AUTOMATIC CHECKOUT

Moscow IZMERITEL'NAYA TEKHNIKA No 1, 1977 pp 66-68

KAPLAN, G. D., and KASPEROVICH, N. L.

[Abstract] An analysis of methods of measuring the transistor parameters (reverse current intensity of the collector, reverse current intensity of the emitter, static transmission coefficient, and reverse current intensity of collector-emitter), with allowance for the parameters of modern elements of electronic equipment, made it possible to achieve contactless agreement of measurements for a number of electrical parameters at a single measuring position, with use of general-purpose measuring targets. The schemes investigated permit joint (combined) checkout of the basic static checkout of transistors at a speed of response of 1-2 msec per parameter. The schemes satisfy the requirements of existing standards, and in addition offer measurement accuracy over a wide range of values of the parameters. The results of the study were utilized in developing a contactless automatic classifier for high-frequency and microwave transistors of low and medium power, with respect to static, high-frequency and pulsed parameters with a total duration of the electron cycle of about 100 msec. Figures 6; references 8 (Russian).

USSR

UDC 621.682.062.1.001.4

PARALLEL OPERATION OF DOUBLE-OPERATION THYRISTORS

Moscow ELEKTROTEKHNIKA in Russian No 11, Nov 76 pp 54-56

BULATOV, O. G., candidate of technical sciences, and ODYN', S. V., engineer

[Abstract] The paper considers parallel operation of two Type KU204 double-operation thyristors (DOT) in a regime of large pulse anode currents. Use of DOT in such a regime is of specific interest in connection with a pronounced increase of the magnitude of the maximally blocked anode current and the possibility of use of DOT in switching units in combination with single-operating thyristors. Various methods are discussed for dividing the current, both with respect to the anode circuit and the control circuit. Figures 4; table 1; references 2: 1 Russian, 1 Western.



USSR

UDC 621.314.64.032.083

## INTEGRATED CIRCUIT BASED SELF-EXCITED OSCILLATOR FOR WIRE SENSORS

Leningrad PRIBOROSTROYENIYE in Russian No 11, 1976 pp 87-89 manuscript received 8 Jan 76

RABUKHIN, B. V., and PANIKARSKIY, A. S., Kharkov Vehicle and Road Institute

[Abstract] A highly-stable IC self-excited oscillator for wire sensors is described. One of the primary problems of using frequency sensors is their increased sensitivity when dimensions, weight, and input power have been reduced to a minimum. Small resonators and ICs would seem to provide the answer. Wire sensors introduce the main error, while the electronics introduce second order error. In order to increase the sensitivity of wire sensors their length must be reduced. This makes it necessary to reduce oscillatory amplitude as well. The self-excited oscillator must provide an amplitude to the wire which minimizes mechanical vibration-induced error. The oscillator developed is an RC-amplifier using IUT401A and IUS231V ICs with regenerative feedback. The IUS231V is used as the output stage: it has low impedance to match the interface cable. Technical specifications of the self-excited oscillator: minimum signal amplitude 100 mV; output oscillation amplitude 1.5 V; maximum relative reduced error (change in  $T_A$  from 0-30°C):  $\pm 0.001\%$ ; maximum relative reduced error (change in  $V_{CC} \pm 10\%$  from rated 12.6V):  $\pm 0.001\%$ ; frequency range 200 Hz-20 kHz. Figure 1; references 2 (Russian).

USSR

UDC 621.373.52

## SHORT-LIFE FREQUENCY STABILITY OF QUARTZ METER-WAVE OSCILLATORS

Moscow RADIOTEKHNIKA in Russian Vol 31 No 12, 1976 pp 49-52 manuscript received 1 Oct 75; after completion 13 Jan 76

RYZHKOV, A. V., and KREMNEV, YU. V.

[Abstract] A study is made of the short-life frequency stability of high-frequency quartz oscillators. An expression is obtained for the effective spurious deviation of the oscillator frequency in a given frequency band. With respect to the short-life frequency stability of a high-frequency quartz oscillator the analysis shows that with an increase in the frequency  $f_0$ , the Q-factor of the resonator varies inversely proportional to the frequency; the high-frequency quartz resonators have a lower Q-factor and if the problem with respect to realizing a high long-life frequency stability is solved by such methods as phase autotuning with respect to the signal of the reference low-frequency generator, then  $P_{c HF}$  can be increased to several hundreds of microwatts. Graphs are presented of the spectral density of the phase fluctuations. Figures 4; tables 2; references 8: 6 Russian, 2 Western.

## THE DESIGN OF AUTODYNES BASED ON FET AND BIPOLAR TRANSISTORS

Moscow RADIOTEKHNIKA in Russian Vol 32 No 1, 1977 pp 82-88 manuscript received 23 Dec 74; after completion 7 Aug 75

BOGACHEV, V. M., LYSENKO, V. G., SMOL'SKIY, S. M., and SOLOVYEV, M. A.

[Abstract] Processes occurring in single-circuit autodynes using bipolar transistors and FETs are analyzed. New operating conditions suitable in terms of autodyne sensitivity are found and engineering methods for designing transistorized autodynes are developed. Autodynes are widely used in close-range radar systems, where they are self-excited oscillators which operate with direct transmission to the antenna. They are affected by the intrinsic signal reflected off the target. This being the case, there is a complex periodic conditions occurring whose curve may be recorded with the aid of a detector and processing system. The shape and spectral composition of autodyne output voltage with small reflected signals are described. Figures 6; references 6 (Russian).

## DETECTION OF AMPLITUDE MODULATED OSCILLATIONS BY THEIR STRUCTURAL PROPERTIES

Moscow ELEKTROSVYAZ' in Russian No 12, 1976 pp 63-67 manuscript received 31 Jul 75

ZAYEZDNYI, A. M., VOYNOV, S. V., and SHAMARIN, A. F.

[Abstract] The efficiency of devices for detecting amplitude-modulated (AM) oscillations based on their processing in accordance with an algorithm which determines the envelope of the AM signal by its structural properties is proved theoretically and in practice. The results of testing the algorithms described using the FAG-1 phasoscopic system confirmed the high efficiency of the proposed devices, and these detectors, which are distinguished from the traditional ones by low inertia, as a result of the latest achievements in radioelectronic technology, can be recommended for use. A block diagram of the detector is presented, and the nonlinear differential equation which must be satisfied by the AM oscillations which determine the algorithm for the operation of the detector is derived. Some oscillograms of the experimental results of using the detector are given. The results are interpreted as the consequence of using the structural properties of the oscillations. Formulas are derived for calculating the quadratic, absolute and relative errors occurring as a result of using the approximate equalities of the algorithms. Although the fitness of the detector and the possibilities of performing operations that are not possible on traditional detectors are demonstrated, the experimental work with the first models indicates that the metrologic characteristics of the detectors with respect to structural properties can be significantly improved and the frequency and dynamic ranges can be expanded. Figures 2; references 3 (Russian).

USSR

UDC 621.376.32(088.8)

A RECIRCULATOR-BASED LINEAR FM GENERATOR

Moscow IZVESTIYA VUZ: PRIBOROSTROYENIYE Vol 19 No 12, 76 pp 77-82 manuscript received 19 May 76

ALEKSANDROV, S. N., and PERETYAGIN, I. V., Khar'kov

[Abstract] A method for shaping linear FM signals with high value of production of frequency deviation at a duration (over 100,000) and high linearity of frequency variation is given. The design of a generator embodying this method, as well as some results of experimental work, are described. Figures 4; references 3 (Russian).

USSR

UDC 621.376.234

AUTODYNE ASYNCHRONOUS MICROWAVE DETECTOR BASED ON A TUNNEL DIODE OPERATING ON THE GENERATION FREQUENCY HARMONICS

Moscow RADIOTEKHNIKA in Russian Vol 31 No 12, 1976 pp 58-62 manuscript received 17 Jan 75; after completion 1 Dec 75

GORBIN, V. V., MALYSHEV, V. A., and PETROSYAN, A. V.

[Abstract] Asynchronous detectors operating on heterodyne frequency harmonics have a number of advantages in comparison with synchronous detectors operating on the first harmonic. The possibility of occurrence of spurious communications channels on the harmonics can always be eliminated by switching the corresponding filters at the input of the asynchronous detector on going from one harmonic to another. A study is made of the optimal conditions of the operation of this type of asynchronous detector. The procedure discussed can be used to consider the effect of autobias on the transmission coefficient of an autodyne asynchronous microwave detector. An experimental study was made of a model of the asynchronous detector executed from a symmetric strip line with air filling and a wave impedance of about 50 ohms. The theory discussed makes it possible to calculate the transmission coefficient of an asynchronous detector of the autodyne type based on a tunnel diode and gives the conditions for optimization of this coefficient. Figures 6; references 7: 6 Russian, 1 Western.

USSR

UDC 538.56

EXCITATION OF A FINITE-LENGTH CYLINDER BY A HERTZ AZIMUTHAL DIPOLE

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA No 8, 1976 pp 1225-1230 manuscript received 19 Sep 75

VASILYEV, YE. N., FALUNIN, A. A., and GORELIKOV, A. I., Moscow Power Engineering Institute

[Abstract] The excitation of a perfectly conducting finite-length cylinder by an electrical azimuthal dipole in the region of resonant frequencies is investigated using the integral equation method. The electrical currents induced on the cylinder surface are defined. The dependence of the field in a far zone on the cylinder dimensions and dipole position with respect to its edges is derived. This analysis established parameter limits, at which the finite nature of the cylinder ceases to be taken into account when calculating the radiation pattern in the transverse plane. Figures 6; table 1; references 7 (Russian).

USSR

UDC 551.510.535

THE RESONANT SCREENING EFFECT OF HETEROGENEOUS GYROTROPIC PLASMA LAYERS

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA No 8, 1976 pp 1130-1141 manuscript received 22 Apr 75

ZHAROV, A. A., and KONDRATYEV, I. G., Radiophysics Scientific Research Institute

[Abstract] Heterogeneous isotropic plasma layers have a screening effect which is related to the presence of a transition of dielectric permeability across zero, that is so-called resonant screening. The reflection characteristics and the field structure inside heterogeneous gyrotropic resonance plasma layers and the external magnetic field are investigated. The entire region behind the resonance plane is shielded. Computer calculations support the validity of the method used to derive the analytical results. Figures 5; references 8 (Russian).

USSR

UDC 621.391:519.27

THE EFFECT OF THE SECOND CENTRAL SPECTRAL MOMENT ON THE AVERAGE NUMBER OF  
OVERSHOOTS OF A STATIONARY STOCHASTIC PROCESS

Moscow IZVESTIYA VUZ: PRIBOROSTROYENIYE Vol 19 No 12, 76 pp 9-15 manuscript  
received 29 Apr 76

KHIMENKO, V. I., Kuybyshev Polytechnic Institute imeni V. V. Kuybyshev

[Abstract] The possibility of estimating the second central spectral moment on the basis of the static characteristics of overshoots of the envelope and those of the phase of the process under study is demonstrated. The author proposes a nonlinear transformation which makes it possible to utilize the magnitude of the "excess" overshoots as supplemental information on the static properties of a stationary narrow-band process. References 12 (Russian).

USSR

UDC 621.373.42

MODE COMPETITION AND SELF-EXCITED OSCILLATOR TRAPPING CONDITIONS

Gor'ky IZVESTIYA VUS: RADIOFIZIKA No 8, 1976 pp 1156-1161 manuscript received 26 Feb 75

MEL'NIKOVA, V. A., and TARANTOVICH, T. M., Gor'ky State University

[Abstract] Two-mode self-excited oscillator trapping conditions are considered for different coefficients of coupling between modes. The amplitude versus frequency curve of the system determines trapping for different amplitudes of the external field and mistuning between its frequency of one of the intrinsic waves of the system. Clarification is given on retuning to single-wave trapping as a function of mode competition. Figures 3; references 6 (Russian).

USSR

UDC 621.391.822

#### SPIKES IN THE ENVELOPE OF ATMOSPHERIC NOISE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 64-71  
manuscript received 24 Oct 75

RUBTSOV, V. D.

[Abstract] A performance analysis of threshold devices exposed to atmospheric noise must involve the statistical characteristics of spikes in the noise envelope. Such an analysis is carried out here for a receiver with narrow-band noise having a log-normal envelope distribution and a uniform phase distribution. First the average number of instants, per unit time, is determined at which the noise envelope crosses a given level. A complete statistical description of envelope spikes is obtained, namely the distribution of their durations, the distribution of intervals between them, and the distribution of periods after they reach the threshold level. The calculations are based on a parameter  $\sigma$  which characterizes the "pulsicity of noise" and the "voltage deviation," the latter depending on the frequency band, on the receiver input characteristics, and on the time of year as well as the time of day. Figure 1; references 4: 2 Russian, 2 Western.

USSR

UDC 681.335

#### MEASUREMENT OF DEVIATION OF RANDOM PHYSICAL PROCESSES

Novocherkassk IZVESTIYA VUZ: ELEKTROMEKHANIKA in Russian No 12, Dec 76  
pp 1394-1395 manuscript received 7 May 76

KAYALOV, GEORGIY MIKHAYLOVICH, dr of technical sciences Novocherkassk Polytechnical Institute, and YERMAKOV, VLADIMIR FILIPPOVICH, Assistant, Novocherkassk Polytechnical Institute

[Abstract] In an experimental analysis of a random physical process, it is necessary to determine first the two primary static characteristics: 1) Mathematical expectation (MX); and 2) Its deviation (DX). A new method is proposed which eliminates previous error by introducing a corrected algorithm.  $V_0$  which is fed to the second input corresponds to the proposed average values of the random process within the averaged interval. At the output of the device a voltage appears which is equal to the actual deviation of the test voltage:  $DV = D \cdot V - \Delta V^2$ . Figures 2; references 4 (Russian).

CZECHOSLOVAKIA

MAGNETIC FIELDS OF LONG CONDUCTORS

Prague ELEKTROTECHNICKY CASOPIS in Czech Vol 27 No 9, 1976 pp 670-683  
manuscript received 27 Oct 1975

COUFAL, OLDRICH, Institute of Special Electrical Power Sources, Faculty of  
Electrical Engineering, Technical University, Brno

[Abstract] Methods of calculating magnetic fields of infinitely long conductors, through which stationary currents are flowing, are reviewed. It is assumed that the cross-section of the conductors remains constant, and that the magnetic field is located in a vacuum. The equations which comply to the vectors of stabilized magnetic fields are developed from Maxwell's equations in which time derivations equal zero. Equations for the calculations of the magnetic fields can be expressed in a finite form when the current density in the cross-section of the conductors remains constant, and when every part of the boundary of the cross-section is represented by a polynomial. The equations which are presented in the article cover calculations of fields with a rectangular cross-section, with a cross-section of a rectangular trapezoid, and that of a section of an annulus. For approximate calculations of fields of various cross-sections a method using a system of squares was developed. Among the many applications of these calculations is the calculation of magnetic fields in rotating electrical equipment which does not contain any parts made of iron. Computer calculations for this method were programmed in the SLANG language for the MINSK-22 computers. Accuracy of the calculations is a function of the selected density of the network of the squares. Figures 7; references 14: 5 Czech, 2 Russian, 7 Western.

Components and Circuit Elements Including  
Waveguides and Cavity Resonators

USSR

UDC 62.501.12

SYNTHESIS OF STATIONARY ITERATIVE FILTERS

Novocherkassk IZVESTIYA VUZ: ELEKTROMEKHANIKA in Russian No 12, Dec 76  
pp 1373-1376

OSMOLOVSKIY, PAVEL FEDOROVICH, dr of technical sciences, professor Ukrainian  
Correspondence Technical Institute

[Abstract] To increase accuracy of automatic control systems, especially those used to track moving objects, various multiple channel iterative systems are used, where the process of reproducing the reference signal is described by recurrent equations. The useful signal is thus successively approximated. Recurrent equations are given for sequential synthesis of optimum channels in terms of the criterion of minimum error deviation. Formulas are presented for evaluation of the gain in precision for each stage of the iterative process in the presence of noise. Figures 1; tables 1; references 6 (Russian).

USSR

UDC 621.3.042

THE DEMAGNETIZING FACTOR OF WOUND TOROIDAL CORES

Moscow AVTOMATIKA I TELEMEXHANIKA No 1, 1977 pp 155-163 manuscript received  
19 Nov 75

ZOLOTOVA, N. M., Moscow

[Abstract] The demagnetizing factor of wound toroidal cores, which is produced by the nonmagnetic inter-turn gap, is theoretically determined. It is shown that this factor depends not only on the geometric parameters of the core, but also on the number of turns; further, that it also depends on the magnetic permeability of the ferromagnet, and may, in any case, be varied within very wide limits. Figures 2; tables 1; references 6: 4 Russian, 2 Western.



USSR

UDC 621.318.576.4

#### STUDY OF STATIC CHARACTERISTICS OF FET ANALOG SWITCHES

Leningrad PRIBOROSTROYENIYE in Russian No 11, 1976 pp 84-87 manuscript received 22 Mar 76

PASYNKOV, YU. A., FURZIKOV, V. M., and CHIRKIN, V. N., Novosibirsk Electrotechnical Institute

[Abstract] Greater and greater use is being made of FETs with p-n junctions in the design of analog switches. In contrast to bipolar transistors, they are not controlled by current but by voltage and have low residual V. This enables analog switches to be created which have high precision, speed and low energy consumption. In designing the control circuit it is necessary to ensure zero voltage between the gate and source of the open transistor to obtain minimum channel resistance throughout the entire range of the input signal. For this reason the gate circuit contains a diode. When the diode is triggered it closes and opens the gate of the open FET from the control circuit. The preferred analog switch circuit is as follows: low switch resistance in open state; large linear range of static curve; possible significant expansion of the linear portion and reduction of open switch resistance by increasing the number of parallel transistors. Figures 4; references 2 (Russian).

USSR

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#### POWER DIVIDERS BASED ON HETEROGENEOUS LINES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 38-44 manuscript received 12 Nov 75

SUKHOVA, T. P., and FEL'DSHTEYN, A. L.

[Abstract] Power dividers may be regarded as linear multipole networks with a single input and k outputs. The use of heterogeneous lines in microwave systems has been known to widen the operating frequency band. Here the feasibility is studied of building high-pass (semi-infinite bandwidth) power dividers with proper power distribution, impedance matching, and interchannel decoupling. It is proved that a heterogeneous line can be found whose input impedance is exactly equal to that of a smooth prototype transition, when each branch feeds a unit-resistance load. Such a power divider requires a decoupling device. A diode-type decoupler offers the advantage of a separate functional and structural component, but it has only a finite bandwidth and cannot be used where the direction of power flow reverses. A resistance-type decoupler, on the other hand, is bidirectional and can have a semi-infinite bandwidth, but must be functionally and structurally integrated with the power divider. The theoretical analysis of power dividers with decouplers of the latter type (continuously distributed resistance between branches or an attenuating film) is supported by experimental data. Figures 11; tables 1; references 12: 6 Russian, 6 Western.

USSR

UDC 621.372.57

POLE SENSITIVITY AND SELECTION OF SCHEMATIC REALIZATIONS OF CHEBYSHEV  
ACTIVE FILTERS WITH LOW Q

Moscow RADIOTEKHNIKA in Russian Vol 32 No 1, 1977 pp 44-48 manuscript received 12 Mar 75

VLADIMIROV, V. L., and MALYUTA, B. D.

[Abstract] Total pole sensitivities of secondary factors of various types of Chebyshev active filters with low Q are compared. Filters made up of non-inverting op amps with regenerative feedback have lower total pole sensitivity than others. The goal is to use capacitors of minimum capacitance, least bias voltages in the circuit, and at the same time, least sensitivity of coefficients of transmission function to change in component parameters. Formulas and tables are provided to aid in choosing the right RC/op-amp filter for a given application. Tables 2; references 6 (Russian).

USSR

UDC 621.372.061

METHOD OF STATE PARAMETERS OF PRINTED CIRCUIT BOARD WITH REALIZATION OF WAVE  
ALGORITHM OF ROUTING

Kiyev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 5(25), Sep/Oct 76 pp 113-118 received 20 Jan 76

PETRENKO, ANATOLIY IVANOVICH, dr of technical sciences, Kiyev Polytechnical Institute, TETELBAUM, ALEKSANDR YAKOVLEVICH, candidate of technical sciences, Kiyev Polytechnical Institute, ZABLUYEV, NIKOLAY NIKOLAYEVICH, engineer, Kiyev

[Abstract] The paper considers a wave algorithm of routing of connections on a topological model of a layer of a printed circuit board. The description of the arrangement of the conductors on the board is accomplished with the aid of a set of state parameters, which change in the course of laying out of the connections. During this a final arrangement of the path is made only after all connections are performed. A topological algorithm of routing based on the description given of the printed circuit board, in the form of a set of state parameters of the sectors of a model was put into practice on a M-222 electronic computer. Also put into practice was a modified variation of an algorithm oriented on a printed circuit board with regularly positioned microcircuits between the adjacent contact areas for which it is impossible to interlay connections. Figures 3; tables 4; references 2: 1 Russian, 1 Western.

USSR

UDC 621.372.88

CALCULATING A LAYERED METAL-DIELECTRIC FINITE-LENGTH STRUCTURE SITUATED IN A RECTANGULAR WAVEGUIDE

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA in Russian No 8, 1976 pp 1218-1224 manuscript received 14 Apr 75

KARUSHKIN, N. F., and FIALKOVSKIY, A. T.

[Abstract] The problem of reflection of a waveguide wave from a semi-bounded layered metal-dielectric structure situated in a rectangular waveguide is resolved. With this solution, the equivalent scheme of a layered distributed diode used to control microwave power is constructed. Use of the principle of variation enabled estimated formulas to be obtained. The problem was solved in a quasistatic limit. Figures 4; references 4 (Russian).

USSR

UDC 621.372.824

GENERAL THEORY OF AXIALLY-SYMMETRIC COUPLING OF CIRCULAR WAVEGUIDES

Moscow RADIOTEKHNIKA in Russian Vol 32 No 1, 1977 pp 49-53 manuscript received 8 Aug 74

VAYSLEYB, YU. V.

[Abstract] The problem of diffraction of axisymmetric magnetic waves in an axially symmetric coupling of two circular waveguides is solved. Formulas are derived for components of the diffusion matrix. Methods are discussed for a numerical solution of this problem. Several numerical examples are provided. Figures 4; references 6 (Russian).

USSR

UDC 621.372.832.4

SYNTHESIS OF CLASS-2 DIRECTIONAL NOTCHED COUPLERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 12 No 1, Jan 77 pp 45-52 manuscript received 18 Nov 75

MESHCHANOV, V. P., and CHUMAYEVSKAYA, G. G.

[Abstract] Class-2 directional notched couplers are synthesized here so that the values of the crosstalk attenuation function, governing the design, remains within given tolerances. Accordingly, the value of the vector of circuit variables is sought which will yield the maximum ratio of upper to lower cutoff frequencies. This problem, treated as a minimax problem, is

now solved in terms of the Chebyshev alternance and a search for the stationary point. The algorithm applies to both symmetric and asymmetric notched circuit structures. Results of numerical computations are tabulated for  $n=3$  and  $n=5$  coupled segments (symmetric) as well as for  $n=2$  and  $n=3$  coupled segments (asymmetric). An analysis of these results and comparison with experimental data indicate that in this class of couplers the addition of more variable components will not make it necessary to increase the number of notches. The design options can thus be greatly extended. Figures 7; tables 2; references 8 (Russian).

USSR

UDC 621.313:621.59

MAGNETIC FIELD AND EMF IN CRYOGENIC ELECTRICAL MACHINES

Moscow ELEKTRICHESTVO in Russian No 1, Jan 77 pp 16-20 manuscript received 13 Jan 76

RUBINRAUT, A. M., and SEMENOVA, T. N., Moscow

[Abstract] Modern cryogenic electrical machines contain no ferromagnetic materials in their stator and rotor, except an outside shield necessary for confining the magnetic field within a given space, so that the magnetic flux here is entirely disoriented. The inductors are made of superconducting or superpure metals and placed inside a cryostat, while the armature coils are made of conventional conductors. The magnetic flux in such a machine is calculated from the field distribution, the problem being reduced here to that of the vector potential in cylindrical regions. The machine is assumed infinitely long so that the problem becomes two-dimensional. Such calculations are shown here for a multiturn rectangular excitation winding of finite width, based on the Biot-Savart law and the superposition principle. The emf is then determined from the magnetic induction of a Y-connected chored winding with the harmonics practically eliminated. The radial component of the magnetic induction varies not only around the cylindrical stator surface but also along its axis. A correction factor accounts for the coil geometry, namely the height-to-width ratio. All these calculations have been programmed for a digital computer. Figures 5; references 2: 1 Russian, 1 Western.

USSR

UDC 538.245

MATHEMATICAL MODEL A FERRITE CORE FOR ANALYSIS OF TRANSIENT PROCESSES IN STORAGE DEVICES

Moscow IZVESTIYA VUZ: PRIBOROSTROYENIYE Vol 19 No 12, 76 pp 43-48 manuscript received 29 Jan 76

SHAMAYEV, YU. M., KONSTANTINOVSKIY, V. M., and VLASOV, V. A., Moscow Power Engineering Institute

[Abstract] As an initial equation for computing transient processes in order to construct the regions of stable operation of a high-speed storage device, the authors propose the model of G. N. GOLOVTSEVAYA. The refinements which they propose for this model increase the accuracy of calculation. The proposed model has already yielded satisfactory results in connection with a mock-up model of a storage device with cycle of less than 0.8 maxwells. Results of the study are illustrated graphically. Figures 5; references 2 (Russian).

USSR

UDC 621.398.2

ESTIMATION OF THE ROUNDING-OFF ERROR OF MULTIPLICATION IN ELECTRONIC COMPUTER SIMULATION OF DIGITAL FILTERS

Moscow IZVESTIYA VUZ: PRIBOROSTROYENIYE Vol 19 No 12, 76 pp 49-52 manuscript received 14 Apr 76

KOMSHILOV, O. A., Leningrad Electrotechnical Institute imeni V. I. Ul'yanov

[Abstract] Questions of the realization of recurrent equations on both general-purpose and specialized electronic computers are studied, with the object of obtaining error estimates for the rounding-off error of multiplication with limited accuracy. Some expressions are given for the dispersion of this error in the realization of difference equations up to the third order. It is found that the magnitude of the error depends largely on the order of the shaping filter and on the parameter  $\alpha$ , for any given discharge capacity of the computer. The data of the calculation can be useful in planning specialized computing devices for the digital processing of signals. Figures 1; references 3 (Russian).

USSR

UDC 681.3

# CALCULATION ALGORITHM FOR COMPONENT CAPACITANCE IN THE TOPOLOGY OF FILM MICROCIRCUITS

Leningrad PRIBOROSTROYENIYE in Russian No 11, 1976 pp 90-92 manuscript received 9 Mar 76

MISHIN, YU. S., Ryazan Radio Engineering Institute

[Abstract] In high-frequency hybrid film microcircuits, the level of connections between elements is plagued by stray capacitance. Current formulas for computing capacitance are useful only for the simplest configurations and contain large errors. In the topology developed for film microcircuits, capacitance between flat components may be solved by an integral equation. The algorithm described was used to write a program in Algol-1204 for the "Odra-1204" computer. The program consists of 1500 instructions. Computation of one matrix element with 10 series members takes about 100 ms. The merit of this algorithm is the possible simultaneous computation of intrinsic and reciprocal capacitance for all film components of interest. The algorithm may be used to automate development of topology in systems in which the receptor form of presenting substrate fields and PC boards is used. References 3: 2 Russian, 1 Western.

USSR

UDC 681.3.06

# METHOD OF MACHINE ANALYSIS OF DIGITAL DEVICES

Moscow RADIOTEKHNIKA in Russian No 1, 1977 pp 100-102 manuscript received after completion 9 Apr 76

KONESHOV, V. N., NIKITIN, A. I., NIKITIN, O. R., and CHECHTEKIN, V. D.

[Abstract] A method of analysis is considered for digital microelectronic devices by means of machine construction of performance graphs. A block-diagram of an algorithm of the construction of a graph is given and examples of analysis are provided. Figures 3; references 2 (Russian).

USSR

UDC 681.3.06:621.952

PROGRAMMED DRILLING OF HOLES IN PRINTED-CIRCUIT ON MACHINES WITH NUMERICAL  
PROGRAMMED CONTROL

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1976 pp 47-48

KRYUCHKOV, V. M., engineer

[Abstract] An ISO control program is written to control drilling of holes in devices using individual control panels. This program consists of frames, each of which contains coded sequence numbers, direction and axial motion quantities, required process instructions, and frame end signal. Each program processes one hole drilling. Because holes are arranged in discrete patterns, this enables the number of control programs to be reduced. References 2 (Russian).

USSR

UDC 681.14:62-19

COMPUTER COMPLEX RELIABILITY

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1976 p 15

PAK, J., engineer (Czechoslovak Socialist Republic)

[Abstract] A major requirement for a computer complex is full operating time (FOT). Because a computer complex consists of a central processor and peripheral hardware, the average recovery time is usually taken to be the redundancy of peripheral devices. Example: the central process may have a FOT of 1,000 hrs and average recovery time of 10 hrs; peripheral devices may have a FOT of 100 hrs. To increase the FOT the peripheral devices should have a FOT of 1,000 hrs. If a computer complex has a FOT of 500 hrs, the average recovery time of the peripheral hardware may be 5 hrs if on-call maintenance is provided. Figures 3; references 3 (Western).



USSR

UDC 681.34'335.8:621.382

#### TWO-DIMENSIONAL BRIDGE FUNCTIONAL CONVERTERS OF TIME-PULSE TYPE

Moscow AVTOMATIKA I TELEMEXHANIKA No 1, 1977 pp 146-154 manuscript received 25 Mar 76

GERASIMOV, I. V., SMOLOV, V. B., and UGRYUMOV, YE. P., Leningrad

[Abstract] Functional converters which reflect nonlinear laws occupy an important place in current computer, control and information-measuring technology. The problems of functional transformation find effective solutions on the basis of composite computing devices, including those of time-pulse type, with the use of which it is possible to obtain devices which are precise and at the same time structurally simple. The authors discuss the possibilities of constructing bridge time-pulse functional converters with approximation of reproduced laws of two variables by second-order polynomials or by their ratios. The designs of polynomial and fractional-rational functional converters based on specific resolving elements with pulse-width and digital control signals are given; also the results of their experimental verification. Figures 5.

USSR

UDC 621.317.39:531.7

#### ELEMENTS OF DISTRIBUTED-PARAMETER COMPUTERS

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1976 pp 56-57

URAKSEYEV, M. A., candidate of technical sciences

[Abstract] Computers are widely used as information-measurement and control systems. Distributed parameters include: heat, electrical, magnetic, mechanical, hydraulic, pneumatic, etc. A distributed-parameter computer is both a primary converter and a processor. Most often we find in use converters with linear or angular motion input and electrical signal output. The Ufimsk Aviation Institute developed new components for distributed parameter computers having improved metrological performance. The specifications are as follows:  $V_{CC}$  12 VAC, 50 Hz; field winding 100 turns; measurement winding 20 turns, measurable motion 150 mm; sensitivity 0.5 mV/mm; overall dimensions 200 x 90 x 40 mm; weight 100 grams. (Function generator). The multiplier specifications are as follows:  $V_{CC}$  = 12 VAC, 50 Hz; number of windings--field 50, measurement 200; range of measurement 45 mm; sensitivity 15 mV/cm<sup>2</sup>; overall dimensions 60 x 60 x 30 mm; weight 300 grams. Figures 3; references 8 (Russian).

## M-6000 ASVT/EDP INTERFACE WITH DATA TRANSFER EQUIPMENT

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 4, Jul/Aug 76 pp 75-77 manuscript received 25 Dec 75

KARACHEV, V. A., and MURAV'YEV, A. G., engineers

[Abstract] Data transfer between the M-6000 and EDP hardware is carried out through connective circuitry covered by certain standards. To match the M-6000, whose components included the K155 ICs, with EDP transmission equipment, a transmitter and receiver have been developed. When the output of the K155 ICs is 0-0.4 V, signal equivalent logic is 0; when output voltage is 2.4-4.5 V, logic is 1. Cycle threshold voltage is 1.4 V. Interface  $V_{CC} = 12.6$  VAC (+5%). The Receiver consists of a threshold sensor and matching stage. The threshold sensor is a bistable trigger using an op amp. The regenerative feedback circuit of the trigger employs a diode bridge which, together with a controlled voltage divider, provides fixed reference voltages at the non-inverting input of the op amp. The trigger is switched when voltage at the op amp inverting input exceeds reference voltage in magnitude. The following electronics are used in the circuitry: KT315 and KT361 transistors, K1UT401B op amps, and KD521 diodes. Figure 1.

USSR

UDC 621.327.22

OUTPUT UNIT OF SYMBOL INFORMATION ON TELEVISION SCREEN

Moscow TEKHNIKA I TELEVIDENIYA in Russian No 1, 77 pp 56-57

KRASOVSKIY, V. A., BEZUSHKO, V. A., GOZBENKO, V. P., NAUMENKO, G. A., and  
TERNAVSKIY, N. P., Kirovogradskiy Radio Products Plant

[Abstract] Use of a unit for display of time, for forming and output of digital information on the screen of a cathode-ray tube, is discussed. The unit can be used as the source of a television signal during transmission of sport and running time without use of an additional transmitting camera. This makes it possible to reduce the size of the apparatus and to lessen the difficulty of work during shaping of television sport programs. Figures 4.

USSR

UDC 621.391.83:681.84.083.8

DECREASING THE COMBINATION INTERFERENCE IN FM RECORDING DEVICES WITH INCREASED DENSITY

Moscow RADIOTEKHNIKA in Russian Vol 31 No 12, 1976 pp 74-77 manuscript  
received 23 Jul 75

GITLITS, M. V., SKALIN, YU. V., and VODNEV, V. A.

[Abstract] An analysis is made of the one of the possibilities for decreasing the combination interference and distortions in an FM recording device with high density and a comparatively large value of  $\beta$  (on the order of one) with a low carrier. The FM signal formation channel and the recording, reproduction and demodulation of the low-frequency FM signal are discussed. The application of the entire set of measures to control the combination distortions and noise such as formation of a low-frequency FM signal with sinusoidal carrier, the recording of the signal with magnetization, the linear regime for amplification of it before conversion of the spectrum during reproduction, the transfer of the spectrum of the reproduced FM signal upward along the frequency scale, and the application of the inclined band filter made it possible to create an FM recording system for phototelevision images with a ratio of the carrier frequency to the maximum modulating frequency of the information signal of approximately 1.4 to 1.8 with a modulation depth of 40 to 60 percent. In this case the distortion level in the system is 40 decibels. Figures 5; references 6 (Russian).

USSR

UDC 621.397.61

# MEANS OF INCREASING QUALITY OF TELEVISION BROADCASTING

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, 77 pp 6-11

MAKOVEYEV, V. G.

[Abstract] The paper considers the current state of the technical base of television in the Soviet Union and the principal trends of work directed towards an increase of the technical quality of television broadcasting. An increase of the performance of television broadcasting depends on the ideological-artistic and technical quality of television programs. The possibilities of increasing the quality of television programs are directly connected with scientific-technical progress in television technology and in the areas related to it. In many aspects the ideological-artistic quality of broadcasting also depends on the state of the technical base of television, because the technical resources of television are a distinctive "tool" in the hands of artists of journalists. Evidence of work on affairs concerned with the development of Soviet television broadcasting is the recently published editorial "Technical Base of Television" [PRAVDA, 1976, 23 Oct], in which an analysis is made of the state of television broadcasting in the USSR and problems for the respective ministries and departments are formulated. The principal qualitative changes in the Soviet television broadcasting system are centralization of broadcasting, massive introduction of color television, wide application of the means of video recording, and new satellite systems for television communication and broadcasting. In the 10th Five-Year Plan reconstruction of the Republic television centers will largely be accomplished. One of the principal problems in an increase of the qualitative indices of broadcasting is the problem of standardization, checking, and measurements. At present the first part of this problem has had an entirely satisfactory solution. Figures 6; references 2 (Russian).

USSR

UDC 621.397.331.2

# INFORMATION TRANSFER IN TV SYSTEMS WITH INTEGRAL SCANNING

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 12, 1976 pp 52-54

NOVIKOV, V. S., SOKOLOV, B. M., and SHUGAYEV, V. N., Leningrad Electrical Engineering Institute of Communications imeni M. A. Bonch-Bruyevich

[Abstract] In the existing method of integral scanning it is necessary to transmit additional information over the communications channel, the volume of which can be highly significant. The version where derivation of the transform, and the storage and processing of it, i.e., an inverse transform, is deformed up to the communications channel, is optimum from the point of view of information transfer and processing. In this case the channel will not be loaded with additional information. The memory size is identical in both cases of integral scanning. An increase in the number of scanning

elements in small-frame TV systems with integral scanning gives rise to the necessity for compressing the dynamic range of the transform with the object of using existing communications channels. Figures 4; references 7 (Russian).

USSR

UDC 621.397.61

#### STRUCTURAL PROPERTIES OF MAGNETIC TAPES WITH CHROME DIOXIDE

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, 77 pp 23-26

VASILEVSKIY, YU. A., VOLODINA, A. P., ZELENINA, L. I., SUBBOTIN, S. S., and KHALETSKIY, M. B., All-Union State Scientific-Research and Planning Institute of the Chemical and Photographic Industry

[Abstract] The structure is investigated of four types of tape produced from chrome dioxide magnetic powder. On the basis of data obtained from the construction of Preysakh diagrams of the magnetic tapes and electron-microscopic analysis, and a comparison of these data with the performance characteristics of the tapes, the effect is shown of manufacturing factors on the performance characteristics. Uniformity of distribution of the particles of the magnetic powder in the working layer of the tapes, connected with the manufacturing process for preparation of the magnetic varnish has the greatest influence on the performance characteristics of the magnetic tapes studied. Figures 2; tables 1; references 2 (Russian).

USSR

UDC 621.397.611 videomagnitofon

#### CORRECTOR OF AMPLITUDE-FREQUENCY CHARACTERISTICS OF VIDEO TAPE RECORDER

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, 77 pp 48-53

KHARITONOV, M. I., and TARYGIN, YE. K., All-Union Scientific-Research Institute of Television and Radio Broadcasting

[Abstract] The efficiency of an automatic corrector of AChKh [amplitude-frequency characteristics] was experimentally checked on the VNIITR [All-Union Scientific-Research Institute of Television and Radiobroadcasting] professional video tape recorder, the "Kadr-5" which is under development at present. The results of the experiment were subjected to the principal conditions of a theoretical analysis and showed good operational possibilities, in both a remote control regime and a regime of automatic correction. The efficiency of operation of the automatic corrector was evaluated with a recording-reproduction of frequency packets, as well as by the results of measurements of the flashes of color subcarriers, the amplitude of which is connected with the frequency characteristics of one or another channel. With the turn-on of the automatic corrector, identical amplitude-frequency

characteristics of the channels of different heads were assured, concerning which equalizing of the amplitude of the flashes with respect to the heads was indicated. In the testing process the amplitudes of the flashes were measured with the absence of automated correction of the amplitude-frequency characteristics and with automatic correction. The maximum residual error in a regime of automatic correction of the amplitude-frequency characteristics did not exceed 0.2 db with various units of video heads, and the duration of the transient process was not more than 10 ms. A prototype of the automatic corrector of amplitude-frequency characteristics was made, which will be used in the video tape recorder, the "Kadr-5." Figures 8; references 3 (Russian).

USSR

UDC 778.5:621.397.13

#### RECORDING OF TELEVISION IMAGES ON MOTION PICTURE FILM WITHOUT LOSS OF LINES

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, 77 pp 43-47

MELIK-STEPANYAN, A. M., MAKAROV, O. P., and KULAKOV, A. K., Leningrad Institute of Motion Picture Engineers

[Abstract] A method is considered for recording television images on motion picture films. The proposed method makes it possible to record television images by all of the methods in use (from the screen of a picture tube, electron or laser beam) on stationary motion picture film with a discontinuous movement of the film during change of the frames and with small loads on both the film and in the units of discontinuous movement. There is no loss of lines. Figures 8; references 5 (Russian).

USSR

UDC 778.534.66:681.323

#### APPLICATION OF ELECTRONIC COMPUTER DURING CREATION OF ANIMATED PICTURE

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 1, 77 pp 40-42

BEZRODNYI, M. S., MAMUT, YE. SH., and GOL'DFEL'D, A. D., Khar'kov Planning and Scientific-Research Institute of Gosstroy [?State Committee of Ministers, USSR for Construction]

[Abstract] The results are considered of an experiment on the creation of machine animated pictures (multifilm) with the aid of an electronic computer. It is shown that creation of animated pictures with the aid of an electronic computer makes it possible to reduce by approximately 5 times the costs and time on production of a film. This gain can be increased several times more with the use of a special-purpose system and an increase of the number of standard programs. Figures 4; references 6: 5 Russian, 1 Western.

USSR

DETERMINATION OF THE PROCEDURAL ERROR OF THE BRIDGE CIRCUITS OF EXPOSURE METERS WITH PHOTORESISTOR

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 12, 1976 pp 17-20

KULAGIN, S. V., and VERYUTIN, V. I., Moscow Higher Technical School imeni N. E. Bauman

[Abstract] A study is made of the procedure for analytical determination of the procedural error of the light metering device of the automated exposure meter (AEU) of a movie camera with a diaphragm controlled from a galvanometer. The circuit diagram of the AEU is presented. An expression is obtained for calculating the procedural error of the AEU in the case where the current passing through the galvanometer is caused by a decrease in the resistance of the photoresistor with respect to the calculated value. Expressions are obtained for calculating the procedural error of the bridge circuit of the exposure meter. Graphs are presented for the procedural error of the bridge circuit of the automated exposure meter as a function of the magnitude of the current through the galvanometer  $I_g$  for various values of  $\gamma_{fr}$  (the tangent to the slope of the logarithmic lux-ohmic characteristic of the photoresistor),  $R_w$  and  $R_p$ .

In order to reduce the procedural error, it is proposed that the resistances of the resistors  $R_w$  and  $R_p$  be reduced by about five times and a moving galvanometer system be used with positive and negative corrections of the  $I_g$  current. The procedural error will be almost cut in half in this case. Expressions are obtained for determining the procedural error in the bridge circuit of the semiautomatic exposure meter with light diodes, the diagonal of which has the input stage of the dc amplifier based on bipolar transistors connected to it. Figures 6.

USSR

UDC 621.396.628:523.164

RATAN-600 RADIO TELESCOPE. INTRODUCTION INTO OPERATION AND INVESTIGATION OF THE FIRST SECTOR

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA in Russian 1976 Vol 19 No 11, pp 1581-1593

PARIYSKIY, YU. N., SHIVRIS, O. N., KOROL'KOV, D. V., BERLIN, A. B., KAYDANOVSKIY, N. L., YESEPKINA, N. A., ZVEREV, YU. K., KOPYLOV, A. I., KORKIN, E. I., LAVROV, A. P., SOBOLEVA, N. S., STOTSKIY, A. A., and TIMOFEYEVA, G. M., Special Astrophysical Observatory, Academy of Sciences, USSR

[Abstract] The basic characteristics are presented of the RATAN-600 radio telescope with a variable-profile antenna which has been completed in the Northern Caucasus. The operating wave range is 0.8 to 30 cm. The northern section of the antenna has been put into operation and investigated. The width of the radiation pattern on all waves is the calculated width (4.3" on an 8 mm wave) the noise temperature of the antenna is 30°K, the effective area of the section on waves longer than 2 cm is about 900 m<sup>2</sup>. Regular observations are being performed on cosmic sources using high frequency radiometers on 2, 4, and 6.5 cm waves, and sun observations are being made in the 2-4 cm range. The authors list the names of a considerable number of persons who assisted in work on the radiotelescope. Figures 14; references 9 (Russian).

USSR

UDC 621.396.628:523.164

ANTENNA-EQUIPMENT COMPLEX FOR THE LARGE SCANNING ANTENNA OF THE PHYSICS INSTITUTE, ACADEMY OF SCIENCES, USSR

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA in Russian 1976 Vol 19 No 11, pp 1594-1606

VITKEVICH, V. V. [deceased], GLUSHAYEV, A. A., ILYASOV, YU. P., KUTUZOV, S. M., KUZ'MIN, A. D., ALEKSEYEV, I. A., BUNIN, V. D., NOVOZHENOV, G. F., PAVLOV, G. A., SOLOMIN, N. S., and TYAPTIN, M. M., Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR

[Abstract] The characteristics are presented for the large scanning antenna of the Physics Institute of the USSR Academy of Sciences on a frequency of 102.5 +1.5 megahertz. The radio telescope is a phased antenna array 384 x 187 m<sup>2</sup> controlled by remote phase-shifters with respect to angle of elevation. The declination scanning sector is from +90 to -20°. Using the Butler phasing matrix, simultaneous reception from sixteen directions is possible. The effective zenith area of the antenna is 2·10<sup>4</sup> m<sup>2</sup>. A brief description is presented of the receiving and recording equipment, and a block diagram of the newly developed equipment complex is given. The authors list the names of a considerable number of persons who assisted in the work. Figures 9; references 10 (Russian).



## FACTORS INFLUENCING THE INTERFERENCE NOISE IN A MULTI-REFLECTOR RADIO TELESCOPE ANTENNA

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 11, 1976 pp 1614-1622

BAKHRAKH, L. D., GRIGOR'YEV, M. I., and SOROCHENKO, R. L., Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR

[Abstract] The expressions are obtained for the reflection coefficient of the noise signal emitted by the excitor and re-reflected back by the elements of the radio telescope antenna. It is demonstrated that the "spurious" effects observed during spectral investigations on the RT-22 radio telescope can be explained by the interference as a result of the indicated re-reflection. Recommendations are made with respect to decreasing this re-reflection.

The methods, formulas and schematic diagrams of how the small mirror reflects the spherical and plane waves from the excitor and the structural elements are presented. A quantitative evaluation of the reflection coefficients for the double-reflector RT-22 antenna of the Physics Institute of the USSR Academy of Sciences is made, and the interference pattern is plotted. Figures 6; references 7: 6 Russian, 1 Western.

## RESULTS OF ALIGNMENT OF THE T-SHAPED VERSION OF THE DKR-1000 RADIO TELESCOPE

Gor'ky IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 11, 1976 pp 1623-1629

IVANOV, S. N., ILYASOV, YU. P., SOLODKOV, V. T., SHCHERBININ, V. YA., Physics Institute imeni P. N. Lebedev, Academy of Sciences, USSR

[Abstract] The results are presented of an alignment of the T-shaped version of the DKR-1000 radio telescope of the Physics Institute of the USSR Academy of Sciences, formed by a movable "east-west" antenna and the northern part of the stationary antenna of the DKR-1000. A study is made of the procedural problems connected with determining the total measured power with use of calibration with respect to the inputs of one of the sections of each antenna. An estimate is made of the accuracy of the measurements and the induction errors. The sensitivity of the DKR-1000 radio telescope is determined. The investigated calibration technique can be used for any multielement interferometer, and the procedure used to process the sine and cosine channel signals to obtain the total power permit a reduction in the requirements on identicalness of the manufacture of the sine and cosine channels of the multiline scanning receiver. The authors thank A. N. Marinin and V. N. Oranskiy for much work with respect to preparation and conducting of the experimental operation. Figures 6; references 8 (Russian).

USSR

UDC 551.510.52

EXPERIMENTAL CHARACTERISTICS OF THE FLUCTUATIONS OF THE RADIO EMISSION OF CLOUDS AT MILLIMETER WAVELENGTHS

Gor'kiy IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 11, 1976 pp 1644-1649

KAYDANOVSKIY, M. N., MAGAMADOVA, T. A., STOTSKIY, A. A., and CHERNYSHOV, V. I., Leningrad Branch of the Special Astrophysical Laboratory, Academy of Sciences USSR

[Abstract] The results are presented of observations on the fluctuations of the radio emission of clouds at 3.25 and 4.1 mm wavelengths. The observations were performed in July 1973 with the NIRFI RT-25 x 2 radiotelescope near Gor'kiy. The radio telescope was directed at the zenith for the observations. The recordings of the cloud radiation in the radio wavelength range were made in sessions lasting about 2 hours each with a time constant of 4 seconds. Some examples of recordings for partial and solid clouds are presented. Synchronous recordings were made at 3.25 and 4.1 mm wavelengths in order to discover the correlation of the radio wavelength emission of the clouds at different wavelengths. The curves for the variation of the emission and the correlation coefficients are included. The structural functions of the brightness temperature fluctuations were calculated. The plotted mean values illustrate the different form of the average structural functions for partial and continuous cloudiness. In the case of continuous clouds, saturation of the structural function was not observed within the limits of the sessions. The authors thank A. G. Kislyakov for interest in the work and cooperation in organization of the experiment. Figures 4; references 6 (Russian).

USSR

UDC 621.396.628:523.164

STUDY OF THE PARAMETERS OF THE RT-22 ANTENNA OF THE PHYSICS INSTITUTE, USSR ACADEMY OF SCIENCES, AT 8.2 mm

Gor'kiy IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 11, 1976 pp 1650-1655

BERULIS, I. I., GRIGOR'YEVA, M. I., and LOSOVSKIY, B. YA., Physics Institute imeni P. N. Lebedev, Academy of Sciences USSR

[Abstract] Using a radiometer with a quantum paramagnetic amplifier, detailed studies were made of the electrical parameters of the antenna for the 22-meter radio telescope at the Physics Institute of the USSR Academy of Sciences at 8.2 mm. A study was made of the characteristics of the directional pattern. The relations were determined for the gain  $G$  and the scattering coefficient  $\beta$  as a function of the angle of altitude:  $G = 1.18 \cdot 10^7 (1 + 0.35 \sin H)$ ,  $\beta = 0.61$  to  $0.07 \sin H + 0.03 \sin^2 H$ . The theoretical value of the utilization factor equal to 0.25 agrees well with the experimental value. The noise temperature of the antenna proved to be 10°K. The

authors list the names of a number of persons who assisted in the work.  
Figures 4; references 13: 11 Russian, 2 Western.

USSR

UDC 621.396.628:523.164

IRRADIATORS OF DECIMETER AND METER-BAND WAVES WITH SWITCHING OF POLARIZATION

Gor'kiy IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 11, 1976 pp 1656-1661

ABRAMOV, V. I., BELOV, I. F., VOLOKHOV, S. A., and MEL'NIKOV, A. A., Scientific-Research Radiophysics Institute

[Abstract] A description is presented of the structural design of two identical irradiators at 290 and 1670 MHz with symmetry and with switching of the linear polarization. Their basic characteristics and the results of a single measurement of the linear polarization of cosmic radio emission are presented, which indicate the efficiency of using the irradiators with switching of polarization for polarization measurements. The following are presented: 1) A general view of the irradiator for the decimeter band; 2) The exciting device executed in the form of a single module in an internal tube of the irradiator; 3) The experimental radiation patterns of the exciter; and 4) The calculated basic characteristics of the irradiator as a function of the angle of opening of the mirror and the measured Stokes parameters Q and U for 12 hours of tracking in the region with the coordinates  $\delta = 64^\circ$ ,  $\alpha = 3$  hours 48 minutes. The graphs indicate that the scattering of the experimental points around a circle is appreciably less in the case of switching of the polarization, which is equivalent to tripling the precision of a single measurement. The authors thank A. M. Pasek and L. V. Popov for submitting the results of the polarized measurements. Figures 5; references 5: 3 Russian, 2 Western.

USSR

UDC 621.372.83

EXPERIMENTAL STUDY OF THE PHASE STABILITY OF WAVEGUIDE CHANNELS

Gor'kiy IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 11, 1976 pp 1662-1668

KRISSINEL', B. B., and MILLER, V. G., Siberian Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation

[Abstract] An experimental study is made of the fluctuations of the difference of electric lengths of two identical waveguide channels required to determine the parameters of the automated phasing system of the Siberian Solar Radio Telescope. The investigations were performed at the radio-physics proving ground of the Siberian Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, Siberian Branch of the Academy of Sciences, USSR. Waveguide channels with a cross section of 48 mm x 24 mm up to 160 meters long at an altitude of 0.9 meters were used. A block diagram of the phase metering device is presented. The results are presented of the statistical processing of the recordings of the phase difference performed in June to July 1974, i.e., in the period of least phase stability of the channels. The processing was conducted on 15 arbitrarily selected recordings of that period with a total duration of the recordings, basically made in the daytime, of about 100 hours. The nature of the fluctuations of the phase difference was determined, the distribution density and the integral distribution density of the phase difference modulus were determined, the power spectrum of the fluctuations of the phase difference was determined and the statistical errors in automatic phasing of the channels were found. The authors thank A. A. Pistol'kors and A. I. Shpunbv for constant attention to the work. Figures 8: 3 Russian, 1 Japanese.

USSR

UDC 523.164 + 681.14

SIMULATION OF RADIO ASTRONOMICAL SYSTEMS AND METHODS OF PROCESSING RADIO ASTRONOMICAL DATA ON AN ELECTRONIC COMPUTER

Gor'kiy IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 11, 1976 pp 1705-1710

BEKETOV, P. V., and KHANBERDIYEV, A., Physico-Technical Institute, Academy of Sciences, Turkmen SSR

[Abstract] Using as an example simulation of a digital radio spectrometer with a modulation receiver of the superheterodyne type, the use is considered of functional simulation on digital electronic computers during an investigation of large radio astronomical systems. An algorithm is obtained for the digital model of a radio spectrometer. The sensitivity of the system, and the dependence of the standard error of measurement of the

spectral power density on the drift of the microwave radio spectrometer amplification are estimated. The algorithm for the digital model of the spectrometer was programmed and executed on the N-222 computer. Figures 5; references 3 (Russian).

USSR

UDC 621.396.628:523.164

#### SYSTEM FOR RECORDING RADIO ASTRONOMICAL OBSERVATIONS

Gor'kiy IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 11, 1976 pp 1727-1731

KOROTKOV, V. S., and FOGEL', A. L., Scientific-Research Radiophysics Institute

[Abstract] A study is made of the two-channel recording system using punch tape for radio astronomical observations. The proposed recording system permits parallel recording of the information on two channels simultaneously on two tape punches. It comprises two analog-to-code voltage converters, the matching and control unit and two punches. It converts parallel binary code taken from the code output of the measuring instrument into parallel-series code of the type required for operation of the punches. A functional diagram of the device is presented which consists of the starting and selection circuits, the circuit for shaping the lines and marks, the matching circuits and discharge cells. MTKh-90 thyratrons are used as the display elements. Each channel of the matching and control unit consists of a matching circuit and eight discharge cells. The circuitry is wholly made with MP-42B, MP-26B, GT403Zh and KT604B transistors and D9Ye and D18 diodes. Figures 2.

USSR

UDC 621.396.629:523.164

#### ACUSTO-OPTICAL SPECTRUM ANALYZERS FOR RADIO ASTRONOMY

Gor'kiy IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 11, 1976 pp 1732-1739

YESEPKINA, N. A., PETRUN'KIN, V. YU., BUKHARIN, N. A., KOTOV, B. A., KOTOV, YU. A., and PRUSS-ZHUKOVSKIY, S. V., Leningrad Polytechnical Institute

[Abstract] The basic peculiarities are considered of a new type of spectrum analyzer for radio astronomy--the acousto-optical spectrograph. The results are presented of an experimental investigation of the acousto-optical spectrum analyzer which is an element of the spectrograph. The output unit of the spectrograph is considered which is fulfilled on the basis of multi-element devices with charging connections, and the "Elektronika-100" electronic computer. The acousto-optical spectrographs are characterized by parameters (resolution and the equivalent number of channels) which are

difficult to realize using spectrographs of other types, in particular, spectrographs with tunable heterodyne and a spectrograph with a set of frequency filters. The spectrum analyzer is being developed jointly with the Special Astrophysical Observatory of the Academy of Sciences, USSR, for the RATAN-600 radio telescope. Figures 6; tables 2; references 8: 2 Russian, 6 Western.

USSR

UDC 621.317.757.3

#### QUARTZ FILTER SPECTRUM ANALYZER

Gor'kiy IZVESTIYA VUZ: RADIOFIZIKA in Russian Vol 19 No 11, 1976 pp 1740-1744

GRACHEV, V. G., and PROZOROV, V. A.

[Abstract] The laboratory of radiospectroscopy of the Special Astrophysics Observatory has developed a 40-channel quartz-filter spectral analyzer. It is designed for operation as part of a quasi-null binary comparison spectrometer with amplitude modulation. The analyzer will be used for observations of the neutral and excited hydrogen lines as well as formaldehyde. A study is made of the schematic diagrams of the most important assemblies of the heterodyne filter and the low-frequency device. Some test results are given. The 40-channel analyzer was tested under laboratory conditions and under observation conditions on the large Puokov radio telescope. In the temperature range from 16 to 40°C the temperature coefficient of instability of gain of the spectral channel is 0.3 percent-deg. Analyzer tests over many hours in the comparison mode demonstrated that the residual imbalance signal of the spectral channel and the comparison channel vary by no more than 0.2 percent from the control signal level in which the comparison is made. The authors thank N. S. Yevgrafov, A. I. Kireyev, and A. I. Kutilov for assistance in making the analyzer, as well as N. F. Ryzhkov for constant attention to the work and valuable council. Figures 3; references 6: 5 Russian, 1 Western.

USSR

UDC 620.178.5.05

EQUIPMENT FOR MULTIPLE-POINT VIBRATION IN IMPACT TESTING

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1976 pp 35-37

SMYSLOV, V. I., candidate of technical sciences, VASIL'YEV, K. I., and YAZVIN, V. M., engineers

[Abstract] The AVDI-1N impact test equipment is described. It contains a master oscillator, force selector, amplifiers, electrodynamic force exciters, "soft" suspension equipment, and control-monitoring devices. Simultaneous operation of many electrodynamic exciters with linear characteristics is possible. They are controlled by input voltages from the current generator. Sine-wave voltage is used as the control voltage in resonance tests. The master oscillator is the variable frequency voltage source to control the current generator and provide reference signals to the phasemaster and synchronous detector. The frequency oscillator has continuously variable ranges of 1-3, 3-10, 10-30, 30-100 and 100-300 Hz, either manually or automatically. Amplitude of up to 100 kgs with error of 102% in amplitude and 1-2° in phase are achieved. Figures 6; table 1; references 6: 5 Russian, 1 Western.

USSR

UDC 621.37/.39

OPTIMIZATION OF TECHNICAL SERVICING OF COMPLEX RADIO-ELECTRONIC SYSTEMS DURING STORAGE

Leningrad PRIBOROSTROYENIYE in Russian No 11, 1976 pp 109-113 manuscript received 22 Mar 76

BARABANOV, A. A., and BURLAKOV, YE. A., Leningrad

[Abstract] Technical servicing of complex radio and electronics systems is now done during storage periods by conducting periodic checks of all units. A method of dynamic programming is used to optimize technical servicing checks. The parameters involved in the program are statistical properties of breakdown, storage time factors, etc. Tables 3; references 5 (Russian).

## AUTOMATION OF PATCHING CORD PRODUCTION TECHNOLOGY

Moscow PRIBORY I SISTEMY UPRAVLENIYA No 11, 1976 pp 50-51

BURTA-GAPANOVICH, A. G., engineer, and PAKNIS, A. B., candidate of technical sciences

[Abstract] The patching cord used with perforation calculating machines is in the form of sections of flexible cable with contact terminals imposed on bare ends, the terminals being pressed in at the points of juncture with the plastic insulation. Functionally and technologically, patching cord has much in common with the flexible cable of various designs now widely used in the electrotechnical, radio and instrument industries. However, its production, as a general rule, has been automated only as regards preparation of the terminals, and assembly operations are normally manual or only semi-manual. The Vil'nyus Adding Machine Plant [Zavod Schetnykh mashin] has now developed a technology which eliminates all manual input in the production of patching cord. The plant has developed automatic and semi-automatic machines and procedures for stamping cord terminals, for assembly, for pressing and for the cleaning and packing of projections. The new methods will raise the level of technology from 28 to 67%, and the proportion of mechanized labor from 52 to 97%, with a probable annual saving (at this plant) of 400,000 rubles. It is noted that the all-round automation of cable production, where terminals are involved, is especially advantageous when there is a large output of the given product.



LATVIA

UDC 621.317.799;538.56

MICROWAVE DEVICE FOR ANALYSIS OF THE PROPERTIES OF SEMICONDUCTOR STRUCTURES

Riga IZV. AKAD. NAUK LATVIYSKOY SSR in Russian No 9, 1976 pp 75-78

GRIGULIS, YU. K., DAGILIS, M. K., RUSMANIS, S. YU.

[Abstract] Semiconductor structures with plane-parallel epitaxial and diffused layers, as well as thin metal and oxide films are created as power rectifiers, SCRs, ICs and solar cells. The development of a non-destructive method and device for measurement and monitoring of parameters is important to improve quality of manufacture. The SVP-3M device, developed at the Laboratory of Electromagnetic Measurements of the Physics and Energy Institute of the Academy of Sciences, Latvian SSR for microwave analysis and monitoring of semiconductor devices is such a device. It employs microwave impedance ( $\lambda = 8$  mm). Its dimensions are 170 x 450 x 300 mm, and it weighs 16 kg. It measures thickness from 5-30 microns (epitaxial), and surface resistances from 0.01-1.0 microns (diffused or metallized) in the 8-100  $\Omega/\square$  range. Specific resistivity of semiconductor chips (0.01-10)  $10^{-2} \Omega.m$ .  $V_{CC}$  220 VAC/50 Hz; P = 100 W.3. Figures 3; reference 1 (Russian).

POLAND

DEVELOPMENT OF MANUFACTURING ENGINEERING CAPABILITIES IN RADIO WORKS imeni M. Kasprzak

Warsaw PRZEGLAD TELEKOMUNIKACYJNY in Polish No 8-9, Aug/Sep 76 pp 242-244

OSAJDA, JERZY, Unitra [Electronics and Telecommunications Industry Union, Radio Works imeni M. Kasprzak]

[Abstract] The author describes the stages of the development of the manufacturing capability of the Radio Works imeni M. Kasprzak. Starting from scratch after World War II, this enterprise developed rapidly during 1951-1968, thanks to modernization of the assembly processes, introduction of printed circuits, automatic assembly line for their manufacture, "wave" soldering, and other innovations. From 1965 on, the production of magnetic recording heads was developed, and in the last five-year period the final assembly, including that of printed circuits, was modernized. A new plant has been put into operation, which manufactures, for the foreign and domestic market, cassette recorders with radio receivers, and many other items enumerated in the article. The plant is equipped with assembly belts of the latest design. Figures 3.

POLAND

ORGANIC ADHESIVES USED FOR JOINING SEMICONDUCTOR STRUCTURAL ELEMENTS TO SUBSTRATES

Warsaw ELEKTRONIKA in Polish No 10, 1976 pp 363-365

PIENKOWSKA, BARBARA and CHROBAK, PRZEMYSŁAW, Industrial Institute of Electronics

[Abstract] The authors discuss the present use of organic adhesives for joining substrates with semiconductor structures in packages and hybrid microcircuits. Characteristics of adhesives, conducting and nonconducting, are described in great detail. The properties of polymeric adhesives are reviewed and specific qualities required of them, including degassing after hardening, corrosivity and electric conduction, are discussed. Classification of aminic hardeners and catalysts is given. Parameters of glue joints and bonding by eutectic joints and soldering are compared and their advantages and disadvantages are pointed out. Tables 3; figures 3.

USSR

UDC 62-578

ISSUES OF EXPERIMENTAL ANALYSIS OF PERFORMANCE OF MAGNETIC-PARTICLE AND HYSTERESIS CLUTCHES

Novocherkassk IZVESTIYA VUZ: ELEKTROMEKHANIKA in Russian No 12, Dec 76  
pp 1389-1393 manuscript received 4 Apr 74; after completion 11 Apr 75

KOCHERGIN, VLADISLAV VITAL'YEVICH, candidate of technical sciences

[Abstract] An arrangement for testing a non-reserving clutch drive employs a dc motor to rotate the test clutch, flexible rod, core attached by rigid coupling to driven shaft of electromagnetic clutch and transformer axle. The use of a rotating transformer instead of tensometers makes it possible to carry out long-term tests under different temperature conditions without periodic calibration (as in measuring momentum). The static and dynamic characteristics of magnetic-particle and hysteresis clutches are investigated. Relationships are given for calculating the rigidity of torsion dynamometers used to test slip clutches, according to the accuracy required in recording exponentially-alternating momentum. Transmission functions of the clutch control winding and momentum transmission functions are defined. The static characteristics of a hysteresis clutch in contrast to magnetic-particle clutches are provided. Figures 4; references 3 (Russian).

USSR

UDC 621.313.322-81.001.24

CALCULATION OF VIBROACOUSTIC CHARACTERISTICS OF STATORS OF POWER TURBO-GENERATORS

Moscow ELEKTROTEKHNIKA in Russian No 11, Nov 76 pp 7-9

GLAZENKO, A. V., engineer

[Abstract] The vibroacoustic characteristics of electrical machines, together with electromagnetic and mechanical parameters, are one of the principal indices of the perfection of construction and the extent of their reliability. Consequently, problems of theoretical forecasting of noise and the vibroactivity of electrical machines (in particular of power turbo-generators) are of vital importance. The present paper, which is concerned with a calculation of the magnetic noise of turbo-units, considers the effect of the acoustic clearance between the core and the body of the stator of a turbogenerator on the emission of magnetic noise of the machine. The results are presented of calculations for real designs of power turbo-units. It is found that the effect of the acoustic clearance on the sound field of the machine is slight. This conclusion is correct for both low and high frequencies. Tables 1; references 3 (Russian).

USSR

UDC 621.313.322-81.001.2

## LARGE SYNCHRONOUS GENERATORS WITH A SMOOTH STATOR

Moscow ELEKTRICHESTVO in Russian No 1, Jan 77 pp 11-16 manuscript received 28 May 76

KIL-DISHEV, V. S., engineer, and RUZHINSKIY, L. N., candidate of technical sciences

[Abstract] The specific power of large turbogenerators can be increased by placing the stator coils in a nonmagnetic slotted layer behind a smooth ferro-magnetic core. This reduces the leakage flux along embedded conductors and thus also the size of the machine for a given power output. Single-layer or double-layer basket coils are used, the former preferable for units with a power rating up to 2.0 GW and the latter preferable in larger units or in cryoturbogenerators. A separately inserted winding with polymer-resin impregnation for rigid embedment is preferred to a monolithic stator structure. Circular or rectangular conductors are wound around nonmagnetic steel tubes through which the coolant circulates. External cooling is effected by conventional means with oil or water. Most difficult in the design is the calculation of the leakage inductance, the electro-dynamic forces on the stator coils, and the additional losses due to eddy currents. The calculations shown here are based on the Fourier method and begin with the magnetic vector potential in polar coordinates, with the artifice of a plane-parallel two-dimensional field in the airgap. The steady-state performance of such a generator is compared with that of a conventional one of the same rating (2.0 GW, 1500 rpm). Figures 4; references 10: 7 Russian, 3 Western.

USSR

UDC 621.314.26:62-83

## CALCULATION OF CARRYING CAPACITY OF POWER SEMICONDUCTOR DEVICES

Moscow ELEKTROTEKHNIKA in Russian No 11, Nov 76 pp 56-59

ZAKHARZHEVSKIY, O. A., engineer, and BOGOSLOVSKIY, A. P., candidate of technical sciences

[Abstract] A large number of converters with power semiconductor devices (PSD) are used in electric drives during conditions of repeated short-duration operation. A calculation of the load capacity of PSDs in such regimes is of great value because they primarily determine the load capacity of the converter. In the present paper calculation and an analysis of the load capacity are made of PSD, in regimes typical for crane electric drives, with use of specific data for these regimes, as well as the parameters of the PSD. The method of calculating the thermal regime and the carrying capacity is based on the presentation of a thermal model of a device in the form of a series connection of passive links and use of the superposition integral. The relations obtained make it possible to perform calculations of thermal regimes and carrying capacity of semiconductor devices used in units with a

cyclical nature of the load. It is shown that the load capacity of PSD in a cyclical regime is determined not only by the magnitude of the duration of the current-carrying capacity, but by the thermal inertness of the construction of the semiconductor device. The carrying capacity of some types of PSD in a cyclical regime depends slightly on the frequency of turn-on and substantially depends on the form of the load. A decrease of the carrying capacity for the purpose of increasing the resistance to short-circuit currents proceeds to an identical degree for various forms of load. Figures 4; tables 1; references 4 (Russian).

USSR

UDC 621.316.543.3

#### MODULAR KEYBOARD SWITCHES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 10, 1976 pp 42-43

VASILENKO, V. I., candidate of technical sciences, ZUBTSOV, M. S., and SITNIKOV, M. V., engineers

[Abstract] Giprougleavtomatizatsiy [State Planning and Design, and Scientific-Research Institute for the Automation of Operations in the Coal Industry], Moscow developed modular keyboards for mnemonic panels, mnemonic boards and control panels. The Keyboards use MP5 and MP7 microswitches and KMAI-IV miniature pushbuttons. The switches are designed to operate in spark-safe media, in the absence of dust, corrosive gas, and other harmful environments. They are manufactured at the Bykov Experimental Automation Equipment Plant of the above institute.

#### Technical specifications:

Compression force (kgs)		0.2
Key motion (mm)		2
Electric lamp	NSM10-55-2	
Brilliance (cd/m <sup>2</sup> )		15
Overall dimensions (mm)		20 x 20 x 58
Weight (g)		14

Figures 2; reference 1 (Russian).

USSR

ASSURING HIGH QUALITY REPAIR OF POWER ENGINEERING EQUIPMENT

Moscow ENERGETIK No 12, Dec 76 pp 21-22

VASSIL, KH., director, PRP Estonenergoremont [Estonian Power Engineering Repair]

[Abstract] Much of the high quality repair of heat and energy producing equipment depends on such factors as improved organization of production, introduction of the latest achievements of science and technology, increased responsibility and efficiency in all teams of a business enterprise, etc. These factors can only be resolved when planning is done to foster socialist competition and creative activity of the workers. A technical monitoring service was founded in 1973 to resolve these issues. Its function increases from year to year. The primary components of quality control are as follows: 1) A set of process indicators which define criteria of repair quality of a specific subassembly; 2) Defect-free manufacture in repair branches; and 3) Information system to ensure continuous awareness of management of work quality. The interaction-of the above systems is aimed at improving technological and design developments, eliminating organizational deficiencies, and preventing defects.

USSR

UDC 537.523.4

A METHOD OF DETERMINING THE DIELECTRIC STRENGTH OF AIR GAPS ALONG WIDE SPANS OF OVERHEAD LINES

Minsk IZVESTIYA VYSSHIKH UCHEENYKH ZAVEDENIY, ENERGETIKA in Russian No 12, Dec 76 pp 31-37 manuscript received 25 Dec 75

ALEKSANDROV, G. N., doctor of technical sciences, professor, and PODPORKIN, G. V., engineer, Leningrad Order of Lenin Polytechnical Institute imeni M. I. Kalinin

[Abstract] A method is shown here for calculating the dielectric strength of air gaps between wide spans of an shv (750 kV or 1150 kV) line conductor and grounded objects such as vehicles. It is based on the concept of a critical charge, according to conventional breakdown theory, but it takes into account the variable capacitance due to sagging of the conductor and the resulting nonuniform charge distribution along the span. The critical charge, corresponding to a 50% probability of breakdown along the span, is assumed independent of the conductor height above the roof of a vehicle and above ground. The theoretical results agree closely with experimental data and this method may, therefore, also be applicable to other more complex shv insulation systems. Figures 4; references 3 (Russian).

USSR

UDC 537.527.3.001.24

CALCULATING THE VOLT-AMPERE CHARACTERISTIC OF A UNIPOLAR CORONA DISCHARGE IN A "CONDUCTOR AND TWO PLANES" SYSTEM

Moscow ELEKTRICHESTVO in Russian No 1, Jan 77 pp 7-11 manuscript received 6 May 76

FAYN, V. B., Chelyabinsk

[Abstract] In electron-ion technology one often uses corona discharge systems where the conductor is located off center between two plane parallel surfaces. In order to design such a system, it is necessary to know the volt-ampere characteristics of the discharge. So far this problem has been solved analytically for two extreme cases: for a conductor equidistant from both planes, and for a conductor sufficiently far from one of the planes to make it, in effect, a "conductor and a single plane" system. Here the problem is solved for the general asymmetric case by two methods: according to W. Deutsch (Annalen der Physik, Serv 5, Vol 16, No 5, 1933) based on electrostatic calculations, and according to V. I. Vasyayev and I. P. Vereshchagin (Elektrichestvo, No 5, 1971; No 5, 1972) based on conformal mapping. The theoretical relations derived by these methods are compared with experimental curves for various conductors (radii 0.10, 0.15, 0.22 mm) 2.9 m from one plane and 0.4 m from the other. Figures 2; references 9: 8 Russian, 1 German.

USSR

UDC 621.3.076:621.3.072.2

RATIONAL USE OF STATIC CAPACITOR BANKS IN AN ELECTRIC DISTRIBUTION SYSTEM  
WITH ASYMMETRIC LOADS

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 12,  
Dec 76 pp 38-42 manuscript received 7 Jun 76

RYBINNIK, A. I., Vinnitskiy Polytechnic Institute

[Abstract] In modern electrotechnology the load in polyphase systems are often asymmetric and, along with it, the demand for reactive power becomes excessive. Single-phase static capacitor banks connected in parallel with such loads compensate the reactive power, but they do not adequately improve (reduce) the negative-sequence voltages and currents. This problem is solved here not by connecting an additional balancer set to an existing supply system but, instead, by a rational redistribution of already connected single-phase capacitor banks. The mathematical model of a balancer set and the algorithm which disallows negative values are now modified, to allow for reducing (negative values) of the capacitor power in some phases and raising (positive values) of it in others. The problem is solved by programming it as an optimization problem, with the phasor quantities represented by their linear components along the quadrature axes. On the basis of typical numerical results, this approximation is found valid. Figures 1; tables 2; references 2 (Russian).

USSR

UDC 621.311.018.41

PERFORMANCE OF POWER BLOCKS IN ATOMIC ELECTRIC POWER PLANTS DURING POWER-  
LOSS FAILURES IN THE POWER SYSTEM

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 12,  
Dec 76 pp 3-9 manuscript received 15 Jan 76

AYRAPETYAN, YU. I., engineer, Polytechnic Institute imeni K. Marx, Yerevan

[Abstract] A study was made to determine the feasibility of combined power and frequency regulation in power blocks of atomic electric power plants during sudden power-loss failures, and to determine the dynamic characteristics of such power plants with water-moderated water-cooled power reactors. The equations of a mathematical analog model, written in per-unit notation, were applied to the equivalent power block with parameters close to those of a plant containing a WWPR-440 reactor, the turbine speed regulators were set to the system frequency, and the power regulation was programmed for maintaining the mean coolant temperature constant over the 70-100% load range as well as the vapor pressure in the secondary loop constant over the 0-70% load range. The performance curves were plotted with the aid of an analog computer for various power dips, various standby capacities, and various reactor regulator systems. An analysis of these results indicates that



water-water power reactors pick up, build up a capability, and have sufficient self-regulation to respond fast to a power loss and to switch to higher power levels. The standby capacity should be considered in the selection of automatic frequency regulators. The power flow in the thermal electric plant and in the atomic electric plant must be taken into account in the calculation of lengthy electromechanical transients due to a power loss. Figures 4; table 1; references 4 (Russian).

USSR

UDC 621.311.6.072.2.001.4

#### PULSE SOURCES OF SECONDARY POWER SUPPLY WITH ENERGY DOSERS

Moscow ELEKTROTEKHNIKA in Russian No 11, Nov 76 pp 17-20

BERTINOV, A. I., dr of technical sciences, professor, REZNIKOV, O. B., CHURBA, V. R., candidates of technical sciences, BOCHAROV, V. V., and KNYAZEY, A. P., engineers

[Abstract] Recently pulse sources of secondary power supply with a capacitance storage device have found wide application. With the object of a reduction of the effect of cyclic processes of charging the energy storage capacitor on the quality of the electric energy of the primary source (low-frequency modulation), it is advisable to employ static converters with a constant output power (so-called power sources). The role of power sources can be performed by controlled inverters of pulse-width modulators which have a network of negative feedback with respect to utilized current (power), or uncontrolled converters transmitting energy with equal doses irrespective of the change of load (so-called energy dosers). An energy doser has a considerable advantage over an inverter and a pulse-width modulator because of simplicity of the circuit, the absence of a system of autostabilization of the power input and the degree of utilization of the installed capacities of its elements.

The present paper considers two basic types of the circuits of pulse sources of secondary power supply with a capacitance storage device based on inductive and capacitance energy dosers. The results of mathematical and experimental investigations make it possible to formulate the following: 1) The real range of efficiency with average utilized power on the order of 0.5--2 kW amounts--for a pulse source of secondary power supply with an inductive energy doser to 0.4--0.6, for a pulse source of secondary power supply with a capacitance energy doser to 0.75--1.85; 2) Choice of the optimum value (with respect to efficiency) of the inductance of the output choke is the most important step in planning the power part of a pulse source of secondary power supply; and 3) Construction of dosers in accordance with push-pull circuits makes it possible to increase the efficiency--for a pulse source of secondary power supply with an inductive energy doser by 10--15 percent, for a pulse source of secondary power supply with a capacitance energy doser by 6--8 percent. Figures 4; references 6 (Russian).

USSR

UDC 621.311.25:621.34

SELF-STARTING OF REGULATED DRIVES FOR AUXILIARIES IN ATOMIC ELECTRIC POWER PLANTS WITH FAST REACTORS UNDER CONDITIONS OF EMERGENCY COOLING

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 12, Dec 76 pp 10-18 manuscript received 22 Aug 75

USOV, S. V., Professor, CHERNOVETS, A. K., candidate of technical sciences, SHISHKOV, V. I., and ZONKHOYEV, G. B., engineers, Leningrad Order of Lenin Polytechnical Institute imeni M. I. Kalinin

[Abstract] For maintaining safety and stability during emergency cooling of the reactor, the main circulation pumps in atomic electric power plants may be driven by electric motors regulated through an asynchronous rectifier system. Self-starting from a generator of comparable power rating is a problem then, inasmuch as large voltage reductions at low speeds are required. This is analyzed here in the case of a three-phase motor with the stator winding energized through an auto-transformer and the rotor winding connected to a diode rectifier bridge inverter, and a matching transformer. The analysis is based on three operating ranges of a diode bridge and four possible modes of independent thyristor control. The energy characteristics, particularly the required reactive power, determine the feasibility of self-starting. The presence of an asynchronous rectifier system makes group self-starting difficult and often impossible. When operating in parallel with unregulated asynchronous loads, such regulated motors must be switched on first. Figures 4; references 6 (Russian).

USSR

UDC 621.314.6:014.2

PROBABILISTIC METHODS OF DETERMINING THE NATURAL FREQUENCIES OF ELECTRIC POWER SYSTEMS WITH RECTIFIERS

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 12, Dec 76 pp 26-30 manuscript received 16 Apr 75

ANISIMOV, YA. F., Nikolayev Red-Banner Order-of-Labor Institute of Ship Building imeni Admiral S. O. Makarov

[Abstract] Electric power systems with rectifiers and capacitor banks operate under conditions where currents may resonate at higher harmonic frequencies and thus cause serious damage. The natural frequencies must, therefore, be determined during the design and this is particularly important in the case of such autonomous electric power systems as those on board vessels. The simplest equivalent circuit consists of a rectified voltage source acting as a generator of harmonics with an internal inductance and the lumped harmonic inductance of all loads in parallel with a capacitance. In the analysis given the natural frequency is represented as a ratio of two random functions of the same random argument. The probability density of a natural

frequency is found by appropriate transformations. Specific numerical calculations indicate that the distribution of a natural frequency in such a system is almost normal. The design of such a system must ensure that the higher voltage harmonics do not fall within the range of the natural frequencies of this system. Figures 3; references 4 (Russian).

USSR

UDC 621.315.1:621.395.73

CALCULATING THE MAGNETIC EFFECT OF ELECTRICAL TRANSMISSION LINES ON TWO-WIRE CIRCUITS OF AERIAL COMMUNICATION LINES

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 12, Dec 76 pp 19-25 manuscript received 30 Jan 76

KALYUZHNYI, V. F., candidate of technical sciences, Moscow Red-Banner Order-of-Labor Electrical Engineering Institute of Communication

[Abstract] Expressions are derived for the interference induced by an overhead electrical transmission line in the two-wire circuit of an overhead communication line. Unlike earlier analyses, neither the sensitivity factor with respect to an external electromagnetic field nor the circuit asymmetry factor is included here. Instead, the parameters of the transmission line and its proximity to the communication line are accounted for. As an example, the effect of zero-sequence currents in a transmission line on the two-wire circuit of a communication line supported on cross arms is found by this method as well as by a standard method, the agreement between both is found satisfactory but with different parameters used in each. Figures 2; tables 1; references 12 (Russian).

## EFFECT OF THE SOIL NONHOMOGENEITY ON THE SURGE CHARACTERISTICS OF GROUNDING DEVICES

Moscow ELEKTRICHESTVO in Russian No 1, Jan 77 pp 72-75 manuscript received 26 Apr 76

MISHKIN, V. M., and RYABKOVA, YE. YA., candidate of technical sciences, Moscow

[Abstract] The surge impedance of a grounding device, just as its steady-state resistance, depends on the electrical properties of the upper soil layers. In order to evaluate this effect, determinations of the surge impedance were made on the basis of physical simulation with a tank containing two layers of sand characterized by different electrical resistivities. Two different combinations of sand layers were used with various configurations of electrodes and grounding beams. The surge coefficient, the ratio of surge impedance to steady-state resistance, was then calculated on the basis of an equivalent homogeneous soil under steady conditions of an alternating current at industrial frequency flowing to ground. When the electrical resistivity of the top layer is higher than that of the bottom layer, then this method yields an overestimate of the surge impedance and the error must be compensated with a correction factor smaller than unity. When the electrical resistivity of the bottom layer is higher than that of the top layer, then this method yields an underestimate of the surge impedance and the error must be compensated with a correction factor larger than unity. Figures 4; references 3 (Russian).

## Energy Sources

USSR

UDC 621.355.5.001.4

### DISTRIBUTION OF CURRENT DENSITY ON ELECTRODES OF SILVER-ZINC STORAGE BATTERY DURING DISCHARGE

Moscow ELEKTROTEKHNIKA in Russian No 11, Nov 76 pp 31-32

BAYUNOV, V. V., candidate of technical sciences, and DASOYAN, M. A., dr of technical sciences

[Abstract] The paper investigates the distribution of current density on the electrodes as well as the distribution of the capacitance which is taken from the surface lengthwise of the electrodes in a silver-zinc storage battery during the process of various conditions of discharge. It is found that in a silver-zinc storage battery one of the factors which accompanies a more uniform distribution of the capacitance taken lengthwise of the electrodes, as compared with a lead storage battery, is the presence of two plateaus on the voltage potential curve during discharge and the large difference of the potentials between them. Figures 3; references 3 (Russian).

CSO: 1860

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